DOCUMENT RESUME

ED 320 501	HE 023 590
TITLE	Bringing Technology to the Issues. Proceedings of the North East Association for Institutional Research Conference (16th, Pittsburgh, Pennsylvania, October 21-24, 1989).
SPONS AGENCY	North East Association for Institutional Research.
PUB DATE	Oct 89
NOTE	265p.
PUB TYPE	Collected Works - Conference Proceedings (021) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC11 Plus Postage.
DESCRIPTORS	Academic Persistence; *Database Design; Educational Planning; Enrollment; Higher Education; *Institutional Research; *Management Information Systems; *Microcomputers; Predictive Measurement; Program Development; Technological Advancement; *Technology

ABSTRACT

The conference program and the texts of 24 papers presented at the conference are provided in this document. Selected papers include: "The Use of the College Student Experience Questionnaire in Policy and Program Development" (Karen Bauer and Dale Trusheim); "Predicting Freshman Performance as Admissions Criteria" (David Zubrow); "Has the Middle Class Been Pressured Most When Paying for Higher Education? More Evidence" (Yuko Mulugetta and others); "Environmental Scanning Networks: A Collaborative Approach to Strategic Planning" (Frederick Loomis and Louis Fabian); "The Development of a Performance Indicator System: A New Direction for Enrollment Management" (David Costello); "Prometheus Unbound or Murphy's Law: A Rural Community College's Efforts to Apply Technology to the Enrollment Management Process" (Robert Karp); "Factors Influencing Graduate Student Retention" (Dolores Maney); "Retention--The Role of Institutional Research" (Ellen Armstrong Kanarek); "An Interactive Model for Studying Student Retention" (Robert Glover and Jerry Wilcox); "Implementing a Plan for Distributed Processing" (Richard Rugen); "The Prediction of College Success: The Methodology of a Pragmatist" (Zandra Goldberg Gratz); "Birth Pangs of an Enrollment Plan" (Ann Weeks); "Ensuring Results from the Information Systems Technology: Five Institutional Research Scenarios" (Angela Suchanic); "The Evolution of a Student Tracking System" (Richard Prull); "The Migration of a Data Base Project from a Primitive Personal Computer to a State-of-the-Art System" (Jeane Vinsonhaler and John Vinsonhaler); "Surveys and Computer Advances: Application of Technology to Enhance the Productivity and Impact of the Sample Study in a Small Research Office" (Glen Lum); "Comparing the Earning of Graduates and Withdrawals from an Urban Institute of Technology" (Gerard Walter and Nancy Neville). (JDD)

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North East Association for Institutional Research

16th Annual Conference

Bringing Technology to the Issues

PROCEEDINGS

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The Westin William Penn Hotel
Pittsburgh, Pennsylvania

October 21-24, 1989

HE 023 590.

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PRESIDENT'S MESSAGE

Our conference theme for NEAIR's 16th Annual Conference was "**Bringing Technology to the Issues.**" This years conference was notable for its large participation by first time presenters, first time attendees and the geographic diversity of the participants (nineteen states and three Canadian Provinces). Although we continue, for the second year of their budget restrictions, to miss our colleagues form the SUNY system, we take heart that next year's conference in Albany should enable many of them to rejoin the flock. Our welcome to Pittsburgh and to the conference itself was provided by Dr. William F. Elliott, Vice President for Enrollment at Carnegie Mellon University. Bill's reputation for combining the practical with the conceptual continues to live on as he challenged the IR community to make more effective use of many of our information assets.

As a sign of NEAIR's maturity, we are pleased to honor two members who were nominated and approved for emeritus membership, Diana Green and Robert Grose. Both of these individuals have contributed much of their time and talent over the years to make NEAIR a professional organization that we can all be proud of.

Program Chair, Louis Spiro, of SUNY-Brockport, provided us with a program that emphasized the technology theme, preserved program time for enrollment issues, and made great use of new talent within the membership's ranks. The evaluations to date have been especially complimentary of his efforts. Congratulations, Lou,... a job well done.

Brenda Bretz, of Dickinson College, provided the Local Arrangement resources and effort. Brenda's eye for registration detail and overall conference arrangements was largely responsible for a really well organized meeting. Our special event, a dinner cruise of "the three rivers" with live music was attended by a record percentage of the conference attendees.

Larry Metzger, completing his third and last year of invaluable service as our secretary, and Peter Farago, who technically completed his term as treasurer in January deserve our heartfelt thanks. Peter also chaired the nominating committee in the wake of Paige Ireland's request to be relieved of her past president duties.

Thanks also to Jennifer Presley, two term Publications Chair, and our new President-elect who finished her last year of service as she hands off to Alan Sturtz of South Central Community College for the coming year. Alan's efforts, in fact, are reflected in this current issue of the **Proceedings.** To our new treasurer, Linda Suskie, my thanks for keeping our budget on target and our goals fiscally responsible.

Finally, to Mike Middaugh, your new President, and all the members of the Steering Committee, conference attendees and participants in the 16th Annual Conference program, I wish to express my gratitude for all your help and the experience of working with you.

Ron Doernbach, Dickinson College
President, NEAIR 1988-89

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OFFICERS AND COMMITTEES 1989-90

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Publications Chair	Alan J. Sturtz	South Central Community College (CT)
1990 Conference Chair	Dawn G. Terkla	Tufts University (MA)
1990 Local Arrangements	Wendell Lorang	SUNY at Albany

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NEAIR 1989 ANNUAL CONFERENCE PROGRAM

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Saturday, October 21

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3:00 - 7:00 PM	Registration	Riverboat Room
7:00 PM- ?	Dinner at area restaurants	

****

Sunday, October 22

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8:00 AM - ??	Coffee Break	Riverboat Room
8:00 AM - 5:00 PM	Registration	Riverboat Room

**** CONFERENCE WORKSHOPS ****

9:00 AM - 12:00 Noon

Newcomers to Institutional Research — Three Rivers #1

Michael F. Middaugh, University of Delaware.

This workshop is designed to give new practitioners in institutional research a hands-on approach to getting started in the field. Using a carefully designed manual of instructional materials, workshop participants will walk through a series of exercises designed to address such issues as: How to ensure data integrity; developing factbooks and reports that are read and used by college presidents; defining critical issues for instructional research at your college or university; identifying sources of data; conducting survey research; using personal computers and commercial software in institutional research and strategic planning; developing forecasting models. The workshop will also address the political pitfalls in institutional research, and will discuss how the new practitioner can effectively link his/her office with the strategic planning/decision making center at their institution.

9:00 AM - 11:30 AM
Sunday Morning, continued

Descriptive Statistics for the Real World — Shadyside

Marian N. Steinberg, Eastern Connecticut State University.

This workshop is geared towards newcomers to institutional research as well as those wishing a refresher. It will focus on the use of descriptive statistics to analyze data in order to produce information useful to decision-makers. An overview will be given of the use and interpretation of frequencies, ranges, means, standard deviations, percentiles, differences among groups, year-to-year changes and regression. Tables and graphs produced by standard software, such as SPSS, will be used to show how to uncover patterns and relationships. This will include a data exploration using histograms, pie charts, scatterplots and other graphic tools.

Introduction to Microcomputer Spreadsheets and Databases — Japan

J. Davis Raborn, Carnegie Mellon University

William Willis, Carnegie Mellon University

This workshop is designed for those new to microcomputer spreadsheets and databases. The first half of the session will concentrate on the general features of these software packages, while the second half will focus on specific applications and selection concerns. Examples of software will be provided for both the PC and Mac environments.

Sunday Afternoon

12:00 Noon - 1:30 PM President's Brunch — Parkview West

Steering committee, conference workers, and workshop presenters.

12:45 PM - 1:30 PM
Sunday Afternoon, continued

Consultant's Corner Norway

Moderator: Mark Eckstein

Come to hear or share experiences and expertise with colleagues about computer issues and problems

IBM and Mac Microcomputers: Advantages, Disadvantages, Similarities and Differences

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1:30 PM - 3:00 PM CONTRIBUTED SESSIONS

Concepts, Current Status, and Issues Concerning Outcomes Assessment in Higher Education Three Rivers #1

James O. Nichols, University of Mississippi

This presentation on the approaches to the assessment of institutional effectiveness concentrates on five areas. These are understanding institutional effectiveness, the means of institutional effectiveness assessment, examples of institutional effectiveness implementation, data formats for institutional effectiveness, and a four-year plan for institutional effectiveness implementation.

Track 3: Enrollment Management and Retention Canada

Moderator: John Jacobsen

The Use of the College Student Experience Questionnaire (CSEQ) in Policy and Program Development

Karen W. Bauer, University of Delaware
Dale Trusheim, University of Delaware

Responses from the Spring 1989 administration of the College Student Experience Questionnaire (CSEQ) at the University of Delaware offers analyses of student outcomes and campus satisfaction. Significant differences in responses by sex, class standing, employment and entry status can be used for discussion with campus officials and can aid in policy and program development.

Predicting Freshman Performance and Retention

David Zubrow, Carnegie Mellon University

Predicting the likely performance of applicants during their freshman year is an important task for many admissions offices. However, for several reasons this task is difficult. As a complement to this effort, predicting retention into the sophomore year offers a different but informative admissions criterion. This paper discusses the method and results of both of these analyses.

Track 4: Theory and Practice of Institutional Research Three Rivers #3

Moderator: Joseph Pettit

Has the Middle Class Been Pressured Most? More Evidence

Yuko Mulugetta, Cornell University
Donald Saleh, Cornell University
Abraham Mulugetta, Ithaca College

The study compares parental contributions in academic years 1984/85 and 1987/88, using the data from three prestigious private universities. The analysis examines whether the middle income families have experienced the greater pressure from parental contributions in recent years.

Impacting Planning for Financial Aid Expenditures: A Master Plan for an Independent College

Lila Seaman, Cedarville College

The paper describes how the office of Institutional Research was used to formulate a plan to improve the effectiveness of recruitment and retention through enhanced financial aid services. The paper describes current status, reviews trends in the external and internal environment, suggests probable future directions, and prioritizes objectives for the future based on profile and impact studies. Activities are prescribed for financial aid and development offices for the 1990's.

2:30 PM - 4:30 PM **HIGH TEA** Main Lobby

Sunday Afternoon, continued

3:30 PM - 5:00 PM CONTRIBUTED SESSIONS

Track 1: Technology in the Institutional Research Office Three Rivers #3

Moderator: Marjorie Raab

A Case Study of Technological Support for Institutional Research at a Small College

Scott Bodfish, Wilkes College

This paper presents a case study of an institutional research project conducted with the Financial Aid office to collect and analyze data on graduates over the past decade. This type of project at a small college was made possible by the technological assistance of microcomputers and an integrated software package. The focus of the study will be the application of the word processing, database and spreadsheet components of the software package to the research project.

The Use of Graphics in the Small Institutional Research Office

Audrey Adam, Tufts University	Freelance Plus
Lois M. Good, Dickinson College	Graphwriter II
Arnold Tilden, Juniata College	Harvard Graphics
Valerie Broughton, Univ. of Minnesota	Excel & McPaint

The purpose of this panel is to provide an overview of the various types of software and hardware currently being utilized in the small Institutional Research office. The means by which graphics are communicated, and the audience and the occasion for the use of graphics are also discussed.

Track 2: Information Systems and Strategies Three Rivers #1

Moderator: Judith Bride

Electronic Mail: Information Sharing at its Best

John A. Dunn, Jr., Tufts University

The new electronic communication media provide helpful tools for the institutional researcher and planner. One-to-one communication is quicker and more flexible; the ability to send news to and ask questions of large groups enormously increases information-sharing; and electronic access to remote data bases will soon be possible.

3:30 PM - 5:00 PM
Sunday Afternoon, continued

Establishing Environmental Scanning Networks

Frederick D. Loomis, The Pennsylvania State University
Louis J. Fabian, Lock Haven University

Environmental scanning is an important, albeit time-consuming and labor intensive element of strategic planning. Environmental scanning networks which electronically link institutions, hold great potential for facilitating this activity among colleges and universities, by fostering collaboration and cooperation as well as supporting the development of environmental scanning data bases.

Track 3: Enrollment Management and Retention Canada

Moderator: Jeffrey Dutton

The Development of a Performance Indicator System: A New Direction for Enrollment Management

David J. Costello, Suffolk University

With the ever increasing emphasis on computer technology in the management decision making process, it is now possible to develop a set of performance indicators which can gauge the level of success or failure of individual departments within the construct of enrollment management. The intent of this paper is to show how enrollment managers can clearly identify the strengths and weaknesses of individual offices, identify and implement reasonable outcome measures, and make attainable short and long term enrollment projections through the implementation of a performance indicator system.

Prometheus Unbound or Murphy's Law: A Rural Community College's Efforts to Apply Technology to Enrollment Management

Robert M. Karp, North Country Community College

This paper will describe the role of the institutional research office in the development of an integrated technologically oriented enrollment management process. Emphasis will be placed on the successes and the "if it can go wrong, it will go wrong" syndrome which plagued the project implementation.

5:00 PM - 5:45 PM
Sunday Afternoon, continued

Consultant's Corner — Norway

Moderator: Lenore DeLucia

Come to hear or share experiences and expertise with colleagues about computer issues and problems.

Integrating Word Processing and Spreadsheet Packages

Sunday Evening

5:30 PM - 6:30 PM	Social Hour (Cash Bar)	Pittsburgh Room
6:30 PM - 8:30 PM	Dinner	Pittsburgh Room

Welcoming Address: Dr. William F. Elliott
Vice President for Enrollment
Carnegie Mellon University

****

Monday, October 23

****

8:00 AM - ??	Coffee Break	Riverboat Room
8:00 AM - 12:00 Noon	Registration Continues	Riverboat Room
8:00 AM - 9:00 AM	SPECIAL INTEREST GROUPS	

SUNY AIRPO — Norway

Sherrill Ison, Monroe Community College

Research on Fund Raising and Alumni/ae — Canada

John A. Dunn, Jr., Tufts University

WORKSHARES/DEMONSTRATIONS

Three Rivers #1

These roundtable discussions are of relatively short duration, allowing participation at a wide variety of these offerings throughout the session.

Enhancing Spreadsheets and Graphs with "Allways"

Lenore A. DeLucia, Rhode Island College

Allways, an add-on to Lotus 1-2-3, can serve to enhance the presentation mode of a Lotus spreadsheet or graph. While the utility of a Lotus spreadsheet is outstanding, its appearance is lacking in many ways. Similarly, Lotus graphics are primitive but still used frequently. Allways permits you to enhance both a spreadsheet and a graph by customizing the type style, size, shading, and outlining to name a few of its features.

Admitting the Wrong People

Elizabeth S. Johnson, Massachusetts Institute of Technology

The standardized score and grade profiles of students who applied to a research university between 1972 and 1989 were grouped into top, high, low and mixed score and grade performance. The decrease in admit rate for the top group and the perceived decline in quality of enrollees will be discussed.

Aptitudinal and Educational Factor as Predictors of Knowledge of Psychology

Paul F. Tero, North Adams State College
Deborah A. Foss-Goodman, North Adams State College
Denise M. Burdick, North Adams State College

The relationships among student's academic experiences and their performance on the GRE-Psychology test were examined. Results are discussed in terms of how this relatively objective measure of students' acquisition of the content of psychology can be used for program evaluation.

Goodbye Coding Columns-Hello Data Entry Screens

Dawn Geronimo Terkla, Tufts University

The primary objective of this demonstration is to describe how Data Entry II has been integrated into one office's normal research routine. Three aspects of the data entry software will be examined: creation of data entry screens and file definition; using Data Entry with SPSS/PC+; and using it with spreadsheet and ASCII files.

9:00 AM - 10:30
Monday Morning, continued

The "Count": Demonstration of Enrollment Management Software

John Zamperini, Carnegie Mellon University
Martha Baron, Carnegie Mellon University

The "COUNT" procedure is used by the Admissions office for monitoring the number of applications entered into the system, predicting applicant quality, tracking admissions decisions and forecasting enrollment deposits. The "COUNT" also tracks how many admissions decisions have been made in various areas, and by using previous years' yields, the prediction of enrollment deposits in various departments and colleges can be performed.

Taking Advantage of Software Command Syntax to Become a Proficient Software User

Dianne P. Bills, Rochester Institute of Technology/NTID

Proficiency in software is vital for institutional researchers. One key to proficient use is understanding the command syntax of software packages. This discussion will focus on the command syntax of some popular word processing and statistical packages, such as Wordperfect, SPSSX and SAS, and the advantages of understanding it.

Track 4: Theory and Practice of Institutional Research Canada

Moderator: Mehran Nojan

Tom Sawyer and Institutional Research: Getting Others to Paint the Fence

Mark A. Eckstein, SUNY Binghamton

Possibly the most time-consuming task in institutional research is collecting the raw data for that research. This presentation describes how highly motivated staff from other offices were used for this purpose. The tools for this process were self-interest, a microcomputer and a relational database.

The Utility of a Faculty Database in Developing and Monitoring an Institutional Salary Plan

Stephen W. Thorpe, Wesley College

Computerized databases assist researchers in performing studies on a timely basis. This paper describes the utility of a faculty database, when accessed by statistical software and other in-house programs, in developing a three-year salary plan to reduce deficiencies and inequities at a small, baccalaureate institution.

9:00 AM - 10:30
Monday Morning, continued

Consultant's Corner Norway

Moderator: Richard Rugen, Kutztown University

Come to hear or share experiences and expertise with colleagues about computer issues and problems.

Local Area Networks and Micro-Mainframe Links

10:30 AM - 12:00 Noon

WORKSHARES/DEMONSTRATIONS Three Rivers #1

These are extended discussion topics which will allow participants to take part in only one or two of the offerings during the session.

Using SPSSX File Management Capabilities to Facilitate Institutional Research Studies

Mary Ann Heverly, Delaware County Community College

SPSSX file management capabilities permit data file "mixing and matching" activities to support institutional research studies. The file manipulation features permit the researcher to conduct analyses using variables distributed across two or more files. These features are helpful in student survey research and in any study that requires student tracking.

From Number 2 Pencil to Final Report: Intervening Technology

Tim Judd, Rockland Community College
Barbara Thelen, Rockland Community College

This demonstration shows how we have applied technology to collecting, processing, summarizing and reporting data. We will describe our development of an automated system using optical scanning equipment, a local area network and several software package applications to read new data and produce a final summary report.

Loan Analyst with Net Present Value and Annual Percentage Rate

Jack Pogany, Georgetown University

A fully automated, macro driven Lotus 1-2-3 model determines the real cost of any loan by using three inflation rates to produce three "net present values" of loan repayment streams. It also accounts for all fees/points to produce a net effective interest rate (APR) and all standard repayment information.

Connectivity: Setting Up Communication Links Between Mainframes, Microcomputers and Administrators

Glenworth Ramsay, The University of Rhode Island
Judith Lawrence, The University of Rhode Island

This session has two themes. The first is exploring methods of presenting information in an attractive and readable manner. The second examines techniques of capturing data on a mainframe, transferring it to a microcomputer and, if desired, moving information between non-compatible microcomputers.

Evolving from Fact Books to a Menu-Driven Reporting and Query System

E. Michael Staman, West Chester University
Thomas Egan, West Chester University
Greg Nyce, West Chester University
Maureen Seybert, West Chester University

At West Chester University, an information system was developed to enable users of official University data to become self-sufficient in obtaining information. The system, which provides menu-driven access to approximately fifty reports in each of the previous forty-five academic sessions, contains information that previously had been accessible only via printed documents. Technologies such as graphics, artificial intelligence and lexicons help provide access to the University's historical database.

10:30 AM - 12:00 Noon
Monday Morning, continued

Track 3: Enrollment Management and Retention — Canada

Moderator: Richard Heck

Retention: The Role of Institutional Research

Ellen A. Kanarek, Applied Educational Research

This presentation is designed for the newcomer to institutional research. It describes what institutional research can do to help faculty and administrators understand what retention means, what information can be used to measure and understand it, and what contributions institutional research can make to increasing it.

An Interactive Modelling Approach to the Study of Student Retention

Jerry Wilcox, University of Hartford
Robert H. Glover, University of Hartford

This paper presents key considerations in the design of longitudinal retention analyses. A decision support system for interactive modeling of attendance and degree attainment is presented, together with findings for a 1984 cohort. Information on admissions, financial aid, academic performance, and expectations about college adjustment can be integrated with student retention, college experience, and alumni involvement.

Monday Afternoon

12:00 Noon - 1:30 PM LUNCH — Pittsburgh Room

Includes Annual Business Meeting

1:30 PM - 3:00 PM CONTRIBUTED SESSIONS

Track 1: Technology in the Institutional Research Office — Oakmont

Moderator: Thomas Judd

The Viability of a One-Person Research Office in a Demanding Environment

Bonnie L. Strunk, Lehigh County Community College

What can a genuine ONE-PERSON research office accomplish? How can multiple top-priority demands for reliable information be met in a timely manner, without sacrificing sanity? This paper illustrates how various products of technology can be used to help a busy researcher maximize time and enhance research projects.

Institutional Research in the Small College Context: Wearing Two or More Hats: What Can a Part-time Researcher Accomplish?

Stephen W. Thorpe, Wesley College
Ronald Doernbach, Dickinson College
Arnold Tilden, Juniata College

Institutional research, in the small college context, is sometimes treated as an "additional duty" and assigned to an individual already responsible for another function within the institution. This panel session, with panelists who "wear two or more hats", will discuss how part-time institutional researchers accomplish research activities at their institutions.

Track 2: Information Systems and Strategies — Three Rivers #3

Moderator: James Swanson

The University Information System: A Relational Database Strategy

Jeffrey W. Bolton, Carnegie Mellon University
Diane L. Gibson, Carnegie Mellon University

Administrative and Academic offices needed greater access to university information. A relational database was chosen to provide inquiry-only access to employee and student data. The development process, system characteristics and the benefits of this strategy for institutional research functions will be presented.

Institutional Researchers as Database Administrators

Wendell G. Lorang, SUNY Albany
Peter Farago, Bentley College
Pat Keating, Carnegie Mellon University
Fred Volkwein, SUNY Albany

There are a wide range of questions about institutional research and database administration. What is database administration? Why and how are institutional researchers getting involved in it? What advice is there for evaluating whether institutional researchers should get involved, or is there any choice? What are the organizational dynamics of this new role? These are some of the issues to be addressed by a panel of several institutional researchers engaged in various aspects of database administration on their own campuses.

1:30 PM - 3:00 PM
Monday Afternoon, continued

Track 4: Theory and Practice of Institutional Research Canada

Performance Standards and Ethics in Institutional Research Based Survey Research: A Preliminary Report

Michael E. Schiltz, Loyola University of Chicago
Robert F. Grose, Amherst College
William Lauroesch, University of Massachusetts
Sandra J. Price, Smith College
Lois E. Torrence, University of Connecticut

This panel presentation will share the preliminary results of a year-long examination of performance standards for the conduct of survey research, and of the ethical issues embedded in those standards. The panel members want the majority of the session time devoted to critical input from attendees: comments on the draft standards, additional examples of good and bad technical and ethical practice, and insights into how these processes supporting good practice and ethical behavior might be continued in the future.

Consultant's Corner Norway

Moderator: David Zubrow, Carnegie Mellon University

Come to hear or share experiences and expertise with colleagues about computer issues and problems

Spreadsheet Packages: Selection and Use

2:30 PM - 4:30 PM HIGH TEA Main Lobby

3:30 PM - 5:00 PM CONTRIBUTED SESSIONS

Track 2: Information Systems and Strategies Three Rivers #3

Moderator: Althea Beck

A Three Way File Merge to Create an Admissions/New Student Survey/Parent Survey Database

Marian Pagano, Tufts University

This paper describes the marketing results obtained from analyses of student admissions and survey data that has been combined with perceptions and opinions of their parents. The secondary purpose is to describe the experience of a three way file merging multiple files, transversing both mainframe and micro environments.

3:30 PM - 5:00 PM
Monday Afternoon, continued

Implementing a Plan for Distributed Processing

Richard H. Rugen, Kutztown University

The Office of Research and Planning is carrying out a plan to download files related to students, personnel, finances and facilities. The paper will describe the progress to date in carrying out the plan, including the acquisition of necessary hardware and software, and steps taken to produce files for downloading.

Development of a Departmental Profile Database and Reporting System: From Spreadsheets to Databases

David Zubrow, Carnegie Mellon University
Diane Gibson, Carnegie Mellon University

This presentation describes the evolution of the method for producing an annual report on the productivity measures of academic departments. The method moved from separate spreadsheets to storage in a relational database with embedded SQL code. Efficiency gains and design principles are discussed.

Track 3: Enrollment Management and Retention Canada

Moderator: Cindy Michaels

The Prediction of College Success: The Methodology of a Pragmatist

Zandra S. Goldberg Gratz, SUNY College of Technology--Farmingdale

A 300 item data base for over 2000 freshmen was created with minimal mainframe support. Using this information, the correlates to students' successful or unsuccessful college experience will be examined. Profiles created will help target students likely to have difficulty in college, for consideration in advisement and counseling.

Birth Pangs of an Enrollment Plan

Ann A. Weeks, SUNY Old Westbury

The assignment to develop a College Enrollment Plan was not an easy task for a recently hired institutional researcher. This paper presents the pitfalls, such as hidden agendas, faculty cliques, and denied realities that were encountered. As a direct result of these experiences, recommendations were developed to help others avoid such impediments. Also, to assist others who must write an Enrollment Plan, the outline that was used is included.

Track 4: Theory and Practice of Institutional Research Oakmont

Moderator: William Lauroesch

Defining Optimal Student Body Size: An Application of Richard Hall's Contradiction Model of Goal Effectiveness

Michael F. Middaugh, University of Delaware
Linda S. Dunn, University of Delaware

Analysis of effectiveness with respect to goal attainment requires full understanding of inherent contradictions in the process of goal definition. Application of Hall's Contradiction Model of Effectiveness to enrollment decisions clearly illustrates the difficulty in assessing effectiveness, and offers solutions to those difficulties.

Ensuring Results from the Information Systems Technology: Five Institutional Research Scenarios

Angela C. Suchanic, Trenton State College

New information systems can serve an important function in colleges. The expectations held of them, however, are not always fulfilled. This paper proposes that institutional researchers who understand the factors beyond technology that influence information production and use are best able to ensure that information systems truly inform institutions.

3:30 PM - 5:00 PM
Monday Afternoon, continued

The Structure and Functions of Institutional Research Offices Within NEAIR

Fred Volkwein, SUNY Albany

This presentation reports the results of a 1989 survey of all the NEAIR member institutions. Information was collected about the staff size, educational preparation, and years of experience of those carrying out the institutional research functions. Respondents indicated the degree to which various types of internal analyses, external reporting activities, and special studies are centralized versus decentralized. The presentation will examine the extent to which these responses are related to organizational size and to the location of Institutional Research in the organizational structure.

Consultant's Corner Norway

Moderator: Judith McCarroll, State of Connecticut

Come to hear and share experiences and expertise with colleagues about computer issues and problems

Database Packages: Selection and Use

Monday Evening

6:00 PM - 10:00 PM SPECIAL EVENT

Dinner and Riverboat Cruise "The Captain's Charter"

Plan to be on board by 6:30 PM!

****

Tuesday, October 24

****

8:00 AM - ??	Coffee Break	Riverboat Room
8:00 AM - 9:00 AM	SPECIAL INTEREST GROUPS	

HEDS-Higher Education Data Sharing Consortium — Oakmont

John A. Dunn, Jr., Tufts University
Jennifer Mauldin, Tufts University

Pennsylvania State System of Higher Education: Institutional Research Directors Group — Shadyside

Thomas Gusler, Clarion University

9:00 AM - 12:00 Noon WORKSHOP — Three Rivers #3

Newcomers to Institutional Research

Michael F. Middaugh, University of Delaware

Repeated from Sunday Morning; prior registration required

9:00 AM - 10:30 AM CONTRIBUTED SESSIONS

Track 2: Information Systems and Strategies — Three Rivers #1

Moderator: Larene Hoelcle

Evolution of a Student Tracking System

Richard W. Prull, Rhode Island College

As computing technologies have matured and the demand for more comprehensive information on students has increased, Rhode Island College has moved from a manual tracking system through two generations of computer-based systems. This paper discusses the limitations of the earlier methods and describes the college's latest tracking system and examples of research based on it.

9:00 AM - 10:30 AM
Tuesday Morning, continued

The Migration of a Database Project from a Primitive Personal Computer to a State-of-the-Art System

Jeane C. Vinsonhaler, SUNY Binghamton
John F. Vinsonhaler, Michigan State University

This presentation discusses the problems and successes encountered during the migration of a research data base project (including the data base and extensive documentation) from a primitive personal computer to a powerful state-of-the-art system. The highly technical migration process is made understandable through concrete examples and personal experiences.

9:00 AM - 10:00 AM CONTRIBUTED SESSIONS

Track 1: Technology in the Institutional Research Office Oakmont

Surveys and Computer Advances: Application of Technology to Enhance the Productivity and Impact of the Sample Study in a Small Research Office

Glen Lum, Harrisburg Area Community College

The implementation of DBase III, SPSS, and optical scan format has expanded the role of the research office, and increased the sophistication of its data analysis. This presentation will review how these enhanced PC tools can be applied to survey research and how invaluable they are to a small research office.

Track 4: Theory and Practice of Institutional Research Canada

Moderator: Bayard Baylis

Analyzing, Interpreting and Reporting Using Admitted Student Questionnaire Data

Ellen A. Kanarek, Applied Educational Research

This presentation is designed to help users of the College Board's Admitted Student Questionnaire (ASQ) with secondary analysis of their ASQ data. The purposes are to determine the focus of the analysis; to choose appropriate subgroups, variables, and analytical techniques; and to select effective tabular and graphic presentation formats for the results.

9:00 AM - 10:00 AM
Tuesday Morning, continued

Diffusing Technology through the Institutional Research Office: Survey the Market First!

Scott Bodfish, Wilkes College

The impact on USERS of institutional research is important in any decision to diffuse technology. A market research approach incorporates the element of user reactions into this process. It is illustrated by reviewing the specific process of providing selected academic planning information in an automated format.

Consultant's Corner Norway

Moderator: Darryl Bullock, Mercy College

Come to hear and share experiences and expertise with colleagues about computer issues and problems

Graphics and Mapping Packages

10:30 AM - 11:30 AM CONTRIBUTED SESSIONS

Track 3: Enrollment Management and Retention Canada

Market Research and Decision Making in Marketing and Enrollment Management

G. Jeremiah Ryan, President, SMG Research Company

A case study of how a community college used several market research techniques (polling, focus groups, direct mail, customer service interviews) to help design marketing and enrollment programs.

10:30 AM - 11:30 AM
Tuesday Morning, continued

Track 4: Theory and Practice of Institutional Research Oakmont

Moderator: Kenneth Cedergren

Alumni Research for Academic Assessment and Fundraising: The Need for Collaborative Efforts

Robert C. Froh, Syracuse University

Alumni research efforts providing information for both assessment and fundraising require two research emphases that have been lacking. These are a stronger market research orientation, and a stronger objective measurement orientation defining attitude and involvement dimensions. Research efforts at Syracuse University sponsored by university relations administrators and faculty will be presented that stress these emphases.

The Influence of Selectivity and Effective Cost on Matriculation Rates at 47 Private Institutions

Jennifer E. Mauldin, Tufts University

The study examines matriculation rates at 47 institutions controlling for selectivity and effective cost. Selectivity in the study is defined as average SAT score for matriculants and effective cost is measured in terms of amount and type of financial aid

Comparing the Earnings of Graduates and Withdrawals from an Urban Institute of Technology

Gerard G. Walter, National Technical Institute for the Deaf
Nancy Neville, Rochester Institute of Technology

The purpose of this presentation is to examine the use of administrative records, specifically data provided by the Internal Revenue Service, to evaluate the effect of college completion on earnings differentials of alumni of the Rochester Institute of Technology. Both the methodology and results will be discussed in depth.

10:30 AM - 11:30 AM
Tuesday Morning, continued

Consultant's Corner Norway

Moderator: Glen Lum, Harrisburg Area Community College

Come to hear and share experiences and expertise with colleagues about computer issues and problems

Statistical Packages

Tuesday Afternoon

12:00 Noon - ???? President's Lunch
Steering Committee Parkview West

The Use of The College Student Experience Questionnaire In Policy and Program Development

Karen Bauer and Dale Trusheim

Institutional Research and Planning
The University of Delaware

Introduction

Concerns about student assessment and college outcomes have become a familiar consideration in the development of college and university agendas over the past several years. Simultaneously, university administrators are interested in monitoring student satisfaction with University services and programs. While relatively few national surveys are available which reliably assess college outcomes, even fewer allow the researcher to address outcomes and student opinion or satisfaction simultaneously. One exception to this situation is Robert Pace's College Student Experience Questionnaire (CSEQ).

The CSEQ is a questionnaire used to measure the quality of effort students put into their experiences in higher education. It also has sections which allow students to rate the university environment and to estimate their progress and gains in 21 objectives of higher education. Findings from the CSEQ can enable campus officials to focus on policy and program revision in areas that will most likely benefit, and possibly, retain students.

This paper delineates some major areas of student success or concern noted on the CSEQ and gives examples of how campus officials might utilize these data in the formation of new policies and/or programs. Literally hundreds of analyses are possible with the CSEQ. This paper is a brief "working" paper which is intended to highlight important results of the survey. Findings noted in this paper can serve as the impetus for discussion on the University of Delaware campus about areas of student success and areas of potential concerns for certain subgroups on campus.

We focused on responses from three subgroups in this analysis: a) transfer students (students who transferred to the University of Delaware versus students who entered the University of Delaware as first-time freshmen); b) student employees (number of hours employed while a student); and c) class standing (freshman, sophomore, junior, senior). We explore three areas of the survey: 1) students' quality of effort in academic areas (e.g., course learning and experiences with faculty); 2) gains in intellectual skills (e.g., general education, writing, analytical, and quantitative thinking); and 3) gains in social/personal skills (e.g., understanding other people, understanding yourself).

Methods and Instrumentation

The CSEQ is an eight page questionnaire designed to examine the quality of undergraduate student education and the sources of student progress toward achievement of goals of a college education. Pace (1984) agues that education is both a process and a product, but that educators typically look only at the end product. He believes that educational programs can be more effectively evaluated when the quality of the educational experience or process is examined, and that the amount, scope, and quality of students' effort are key factors in identifying the quality of the educational process.

The CSEQ consists of three main parts. The first section, The Quality of Effort Scales, contains items that measure the amount, scope, and quality of effort that students put in to such areas as college facilities and interacting with faculty and peers. The second section, Characteristics of the College Environment, allows students to characterize the college environment with respect to development of academic, creative, vocational, analytic, and cultural activities. The final section, Estimate of Gains, allows students to indicate the extent to which they have made progress or gains in 21 objectives of higher education. Reliability and validity data on the CSEQ are quite high (see CSEQ Test Manual and Norms, 1984).

The CSEQ was mailed to a stratified, random sample of 3,000 undergraduate students on the University's main campus in the Spring, 1989 semester. Usable responses were received from 921 students for a response rate of 31 percent. (The length of the survey likely explains the low response rate.) No follow up mailing was conducted. Weights were assigned to respondents from different colleges, to ensure that the overall results were not disproportionally biased given the stratified sampling procedure.[1]

The Quality of Effort scales include a total of 142 likert-type questions in 14 scales or areas of activities. Within each scale, the questions range from activities that require little effort or involvement to those that require more. Students are asked to report how often they have engaged in each of the activities during the current school year by checking "never," "occasionally," "often," or "very often." Responses are assigned one point if answered "never," two points for "occasionally," Three points for "often," and four points for "very

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[1] There are eight undergraduate colleges at the University of Delaware. We undersampled students from the large enrollment colleges (e.g., Arts and Science, Business, and Engineering), and oversampled from the smaller colleges (e.g., Agriculture, Nursing, Physical Education). All the samples were randomly selected from the full population in each college.

Weights to return sample proportions to the population values use the following formula:

$$\frac{\text{N of men in College A population}}{\text{N of men responding from College A}} = W_1$$

$$\frac{\text{N of women in College A population}}{\text{N of women responding from College A}} = W_2\text{; etc.}$$

These formulas will inflate results from undersampled colleges and deflate results from colleges which were oversampled.

often." Each student's quality of effort score can thus range from 10 to 40, with 10 meaning that a student never engaged in the activities, and 40 meaning that the student engaged "very often" in all the activities.

The Estimate of Gains section consists of 21 statements of college objectives such as vocational training, a broad general education, and ability to think analytically. Students are asked to indicate how much progress they have made in each area on a four-point: scale "very little" (coded 1), "some" (coded 2), "quite a bit" (coded 3) or "very much" (coded 4). These gains are an indication of the extent to which students believe they are achieving important objectives of their college education.

Results

Quality of effort in academic activities. In an effort to focus on student gains that come from the quality of effort put in to certain college experiences, Pace (1984) suggested that the quality of effort in scholarly/intellectual activities could be defined by scores on four of the thirteen quality of effort scales: Library Experiences, Course Learning, Experiences with Faculty, and Experience in Writing Scales. Results for these four quality of effort scales for our three subgroups are shown in Table 1. In all four areas, for example, transfer students reported that they expend slightly less effort than students who enrolled at the University as freshmen. In addition, freshmen reported lower efforts than upperclassmen on three of the four academic variables. Freshmen reported putting more effort in their writing experiences than other students. An interesting trend emerged with students who were employed. Students who worked the most (30 hours or more per week) reported lower quality of effort averages than students who worked a moderate amount or not at all. Although the group averages did not vary by large amounts in an absolute sense (one to two points on the scale from 10 to 40), the differences are about one-fifth or one-quarter of a standard deviation.

Gains in Intellectual skills. Table 2 highlights respondents' gains in intellectual skills for the three subgroups of students. As shown, transfer students and non-transfers reported similar gains in writing, analytical thinking, and gaining a broad general education. First-time freshmen did, however, report significantly greater gains in the ability to learn on their own ($f= 3.6$, $p=.05$). As Shown in Table 2 and Figure 1, freshmen reported lower gains than upperclassmen on each academic variable. Although there were no clear cut trends with respect to number of hours employed, students who worked part-time (10-20 hours per week) in general reported greater gains than students who worked 30 or more hours per week or not at all. For example, students who work the most (30 hours) reported the lowest gains in analytical thinking but the highest gains in writing skills.

Gains in personal/social development. Table 3 presents results for some of the variables which describe social and personal gains achieved by University of Delaware students. Transfer students reported significantly lower gains in developing their own values and ethics, understanding other people and themselves, and the ability to be a "team member." As in Tables 1 and 2, freshmen generally reported lower gains than upperclassmen. Regarding the number of hours employed, the trend again emerged in which students who worked about 10 to 20 hours per week generally reported the greatest gains. Responses for gains in

Table 1

Quality of Effort - Academic Activities

	Course Learning		Experience with Faculty		Library Experiences		Experience in Writing	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Entry Status								
Transfers	28.2	5.1	18.4	4.6	17.1	4.5	23.9	6.2
Non-Transfers	29.6 *	5.0	19.0	5.1	18.6 *	4.5	25.1 *	5.6
Classification Level								
Freshmen	28.2	5.1	18.0	4.2	18.1	3.7	26.2	5.7
Sophomore	30.1	4.3	17.9	4.1	17.1	3.8	23.7	5.7
Juniors	29.8	4.5	19.0	5.4	18.6	4.3	24.2	6.2
Seniors	30.0	5.1	21.4	5.7	20.3	5.6	25.4	6.6
Hours Employed								
None	29.1	4.9	18.4 *	4.7	18.3	4.3	25.5	6.2
About 10	29.9	4.7	19.3	5.0	18.5	4.8	24.5	5.5
About 15	30.7 **	4.8	20.0	5.2	19.6	4.7	24.5	6.6
About 20	29.1	5.4	20.0	5.7	18.4	4.3	24.5	6.0
About 30	27.9	3.6	18.8 *	5.3	18.0	5.1	22.9	5.0
More than 30	28.5	3.7	17.2 *	4.7	17.2	4.5	24.8	6.3

* values are significantly different from others in group at .05 level

** value is significantly different from all levels for course learning except about 10 hrs/wk.

Table 2

Gains in Intellectual Skills

	Gains in Broad education	Analytical Thinking	Learn on own	Quantitative Thinking	Writing
	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$
Entry Status					
Transfer	2.7	2.6	2.9	2.2	2.6
Non-Transfer	2.7	2.7	3.1	2.3	2.6
Classification Level					
Freshman	2.6 *	2.4 *	2.8 *	2.1	2.5
Sophomore	2.8	2.7	3.1	2.2	2.5
Junior	2.9	2.7	3.2	2.2	2.7 *
Senior	2.7	2.9	3.2	2.6 *	2.8 *
Hours Employed					
None	2.7	2.7	3.0	2.2 *	2.5
About 10	2.8	2.7	3.1	2.3 *	2.7
About 15	2.9	2.6	3.1	2.3	2.5
About 20	2.7	2.7	3.1	2.4	2.7
About 30	2.7	2.6	3.0	2.6	2.6
More than 30	2.7	2.4	2.9	2.0 *	2.8

* Values are significantly different from others in group at the .05 level.

Note: Scale ranges from 4 to 1 with 4 highest (gained "very much"), and 1 lowest (gained "very little").

Table 3

Gains in Social/Personal Skills

	Gains in Developing own Values and Ethics	Gains in understanding Other People	Gains in Understanding Yourself	Gain in ability to be a team Member
	$\bar{X}$	$\bar{X}$	$\bar{X}$	$\bar{X}$
Entry Status				
Transfer	2.5	2.8	2.8	2.4
Non-transfer	2.8 *	3.1 *	3.0 *	2.7 *
Classification Level				
Freshmen	2.6 *	3.0	2.8	2.4 *
Sophomore	2.8	2.9	2.9	2.6
Junior	2.9	3.2 *	3.2 *	2.8
Senior	2.8	3.0	3.1	2.9
Hours Employed				
None	2.7 *	3.0	2.9	2.6
About 10	2.9	3.1	3.0	2.9
About 15	2.8	3.0	3.0	2.7
About 20	2.9	2.9	3.1	2.5 *
About 30	2.5 *	3.0	3.1	3.1
More than 30	2.3 *	2.5 *	2.6 *	2.2 *

Note: Same scale as Table 2.

* Values are significantly different from others in group at the .05 level.

developing their own values and ethics, for example as shown in Figure 2, found those students working part-time to make the greatest gains, while students who worked none or 30+ hours per week reported the smallest gains.

Discussion

As administrators try to to develop policies and programs for a variety of student development concerns, the above findings can give campus officials needed information about their student population which can allow them to make more informed decisions. As opposed to assuming or guessing that students need a certain program, information from the CSEQ can assist officials in focusing programmatic efforts.

Recent scholars (Astin, 1977; Upcraft, 1986; Terenzini & Pascarella, 1980; Tinto, 1987) have reported that college students make the most of their college years when they are involved in extracurricular activities. Often, participation in intercollegiate or intramural sports, greek life or other social clubs, or on-campus employment enable students to meet other students that they might not meet in class, prioritize their daily schedule, and, in general, round out their college experiences.

Transfer students are sometimes overlooked when it comes to offering assistance to new students on campus. Perhaps it is assumed that transfer students already "know the ropes" and do not have the same orientation needs as first-time freshmen. Findings presented above show strong discrepancies between transfer and non-transfer students for the quality of effort and estimate of gains achieved at the University. With the finding that transfer students report significantly smaller gains in relationships with other students and the ability to be a team member, student affairs officials might want, for example, to develop a program that will enable transfer students to become better acquainted with other students. Such a finding might also, for example, urge officials to house more transfer students.

Campus officials might also choose to survey transfer students again to further investigate their quality of student life. Frequently, parking and/or place(s) to stay between classes (e.g., the student center) are issues of concern for commuting transfer students. An additional survey which builds on CSEQ findings might enable administrators to modify current parking or study space allocation to better suit the needs of transfer students.

Findings regarding differences by class standing are also consistent with CSEQ doctoral norms and with the literature on college student development (Chickering, 1969; Perry, 1970). Traditional-aged underclassmen typically spend a great deal of time and energy making the transition from high school to college. New students who live away from parents often focus their energies on making new friends, establishing self-identity, and participating in a variety of social activities. Underclassmen do develop their academic abilities, but are more stimulated by intellectual challenges after social and emotional patterns have been established.

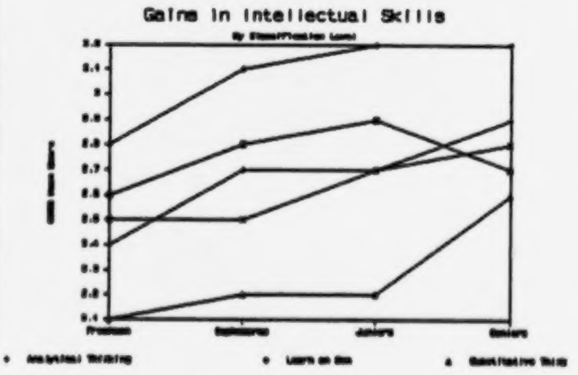

Figure 1

Self-Reported Gains in Intellectual Skills

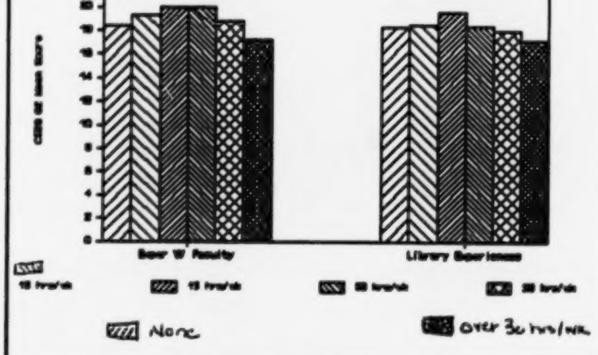

Figure 2

Quality of Effort- Experiences with Faculty and Library Experiences

Based on the finding that freshmen and sophomores put less effort into academic considerations, and also reported smaller gains in intellectual and personal skills than juniors and seniors, college officials might help ease the transition of new students into college by actively supporting activities and events that will enhance social skills. In addition, faculty might choose to conduct special study groups or coffee hours to encourage social as well as intellectual development of underclassmen. Minimally, findings from the survey could be circulated to department chairs and deans for discussion.

Findings reported above indicated that respondents who worked more than 30 hours per week said they put less effort in to campus experiences and made smaller academic and social gains. This finding is consistent for other factors, too. Students who worked 30 or more hours per week reported the smallest gains and least involvement in collegiate activities. For example, students who worked 30 or more hours per week reported the least involvement in clubs, athletics and recreation, the student union, and acquaintances with other students. In addition, students who worked 30 or more hours per week reported the smallest gains in familiarity with computers, ability to put ideas together, developing their own values and ethics, in understanding their self and other people, and in ability to work on their own. Perhaps those respondents who worked more than 30 hours/week were so busy working that they did not have enough time for personal or academic needs. Both Tinto (1987) and Astin (1975) argue that the demands of employment may hinder student retention. Full-time and off-campus employment are more harmful than part-time and on-campus work (Tinto). And, according to Astin (1975), some forms of on-campus employment, such as work-study programs, may enhance one's chances for completion. Often, such on-campus employment helps students become integrated into the campus community. Such integration likely improves the retention rate. Academic advisors or career planning and placement officers might use this information when they discuss employment needs with students. Similarly, student supervisors might find it most effective to have students working 20 hours per week or less. Since findings showed that intellectual and social development suffered for those who worked 30+ hours/week, students who work and attend school full-time might not be able to juggle all their demands as well as students who work fewer hours.

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Predicting Freshman Performance as Admissions Criteria

David Zubrow
Carnegie Mellon University

This paper describes some new ideas regarding the prediction of freshman performance as an admissions criterion. Many colleges and universities employ equations that predict freshman grade point average (FGPA) from a linear combination of SAT scores, achievement test scores, and high school GPA or high school percentile rank. The use of such equations is attractive because they are based on an objective analysis of quantitative data. Multiple regression analysis is a common technique for uncovering the optimal way to combine these variables to predict FGPA.

These equations are often used to rank applicants in terms of desirability for admissions. However, the accuracy of such predictions needs to be assessed if we are going to have any confidence in the equations we use. One shortcoming of traditional measures of statistical goodness-of-fit is that they treat all errors of equal magnitude with equal importance regardless of where they occur along the GPA scale. I demonstrate a method for taking into account the seriousness of different errors and show how to tabulate the results of these predictions in a way that forcefully shows their degree of accuracy after having taken into account the weighting of different kinds of errors.

Forces Working Against Accurate Predictions.

The processes generating the data used in analyses geared towards the creation of equations for predicting applicants' FGPA work to reduce the magnitude of the observed relationship of predictor variables such as SAT scores, achievement tests, and high school GPA with FGPA. Institutional researchers should be aware of at least four problems associated with conducting this type of research.

1. *Restriction of Range due to NonRandom Sampling.*

Here two types of influences lead to restriction in the range of admissions variables. First, applicants self-select in terms of which schools they apply to.

College Guides which publish average SAT scores would be an example of a reason why a school's applicant population would not be generally representative of the distribution of applicants on such measures. A second reason leading to restricted range would be the admissions process. To actually carry out research on predicting freshman performance, researchers need the dependent measure, FGPA. Practically speaking, this means conducting the research on enrolled students who complete one or two semesters. Again, only a skewed part of the distribution is available for research and this group of students is usually more homogeneous than the general population of applicants. The increased homogeneity reduces variation in the sample of admissions predictors and therefore also in the resulting correlation between admissions predictors and FGPA.

2. *The reliability and validity of the measures used.*

At the national level, the College Board has questioned the ongoing validity of the SAT's. According to this study the relationship between SAT's and freshman grade point average has changed somewhat. But I think we might agree that the validity of SAT's, achievements, FGPA, and high school grade point average (HS GPA) or high school rank is acceptable. However, the reliability of HS GPA and FGPA may be questioned. At one level, the differences in grading practices from school to school reduce the reliability of HS GPA. Also, course loads and curriculum content may change over time so that the abilities and experiences that these variables measure are not the same from year to year.

3. *Lack of desired information.*

As mentioned earlier, the most typically used variables in equations predicting FGPA are test scores and quantitative high school record information. However, success in college is unlikely to be solely a function of academic indicators only. A number of non-academic influences may be useful for predicting FGPA. Motivation or desire to achieve, academic and social integration, independence, self-confidence are some factors that seem to be worth exploring. The existence of important unmeasured influences on FGPA works against researchers trying to develop equations that accurately predict applicants' FGPA.[1]

4. *Cross Purposes of Admissions and Grading.*
Finally, it is important to note that the functions of admissions and grading work at cross purposes when it comes to conducting research aimed at improving our ability to predict freshman performance. The admissions process will produce a group of students who are more homogeneous than a random sample of students or than all applicants. Only those who have scores above a certain level will be accepted and only those who find the school attractive will enroll. On the dependent measure side, the fundamental principle of grading is to distinguish among individuals based on their performance. So one force tends to produce a sample that is relatively homogeneous in terms of predictor variables. The other force tends to produce a relatively differentiated sample in terms of the dependent measure. These forces work against observing high correlations between the predictor and criterion measures. Therefore, expectations as to the degree of statistical relationships likely to be found need to tempered by a realization of these problems.[2]

Some suggestions for improving prediction using these variables.

The following methods can help improve the results from regression analyses designed to produce predictive FGPA equations.

1. *Check the distribution* of the predictor variables for your population. Transforming skewed variables will improve the statistical fit of the resulting equations. For instance, I found in my analysis that the scores of our students on several measures such as SAT's, math achievements, science achievements, and high school rank were all highly skewed. By using the appropriate log transformation on these variables, their empirically observed relationship to FGPA was increased.

2. Another technique to investigate is the *use of various composite variables* like average achievement score. The motivation here is to develop equations

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[1] These influences are part of the error term in the regression equation.
[2] The few published studies that I've seen on this topic report R-squares from .2 to .3.

that can be applied to the majority of applicants regardless of what kinds of test scores they report. This will reduce the number of predictive equations that must be used by the admissions office to predict a FGPA. Composites variables are probably as valid as individual test scores with respect to their use in the admissions process and probably more reliable because they are based on multiple test scores. As an example, instead of using just a physics achievement test to determine an applicants desirability for admissions to a physics program, this method suggests the use of the average science-related achievement test score. By doing this I was able to develop single equations which cover more than 70% of our applicants in each of our colleges.

3. *Check for influential outliers.* A variety of methods or statistics have been developed to help identify influential outliers which might unduly skew estimates of the relationships between predictors and the criterion measure. Influential outliers could be deleted from the data and then new equations estimated on the new data. One new technique for identifying outliers is robust regression. This technique has several advantages over the more common method of jackknifing. Some its most important advantages are that (1) the analysis can be carried out in one or just a few "runs" and (2) outliers are readily identified from their residuals. .

A Method for Displaying and Comparing Alternative Prediction Algorithms.

While exploring methods for predicting freshman GPA, I thought about the means for assessing how well various algorithms work. First, it can be quite informative to assess the accuracy of prediction at given levels of FGPA. There is no reason to assume that accuracy is constant across all levels of predicted FGPA. For instance, the accuracy of prediction might be quite good for students who predict very high or very low. Yet, using the same algorithm, the accuracy of prediction in the mid-range might be poor. Second, in terms of assessing competing algorithms the method should allow for the inclusion of information regarding the seriousness of the errors committed.

This method consists of three steps: crosstabulating predicted with actual FGPA's, developing a matrix of error weights, and computing a matrix of error scores.

1. *Crosstabulate Predicted with Actual Freshman GPA.* I used multiple regression to create a new equation for predicting FGPA. The predicted and actual FGPA's were then aggregated into ranges that were meaningful to our admissions office. Next, the predicted and actual FGPA's were crosstabulated as shown in Table 1. Then I looked at the distribution of students who were predicted in a GPA range in terms of their actual GPA's. As an aid to assessing the distribution within a particular FGPA range, the distribution can be represented as proportions rather than as frequencies. This also makes comparison across ranges easier. By doing this it becomes clear as to where the prediction was good and where it was bad.

As a summary measure of predictive accuracy the percent agreement can be computed. This is simply the sum of the cell counts on the diagonal divided by the total number of cases. This process can then be repeated using the predicted FGPA's from our existing equations and the actual FGPA's.[3] The existing and new equations can be compared in terms of their accuracy as measured by percent agreement. This statistic, however, does not make use of error weights.

2. *Develop an error weights table.* To get error weights I asked our admissions officers to weight the seriousness of errors represented by each cell in the predicted by observed table. The table embodies two types of errors: errors of omission and errors of commission. Errors of omission would be made when an applicant who would have done well is predicted so low that they are not offered admission. Alternatively, an error of commission is made when a student is predicted to do well, is admitted and enrolls, and subsequently earns a relatively poor FGPA. Admissions officers were asked to think about the implications of these scenarios and then to assign weights between 0 and 1 to the cells in the matrix. Table 2 shows an example of an error matrix.

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[3] Discriminant analysis can also be used to predict FGPA. FGPA must be represented as a series of groups or ranges. In this case, discriminant analysis will predict group membership directly. The results can be tabulated and evaluated as described.

3. *Compute error scores.* To compute error scores for any algorithm, multiply each cell in the observed frequency table by the corresponding cell in the error weight table. Table 3 shows the results for the example. One overall measure of performance is the total number of errors in the table divided by the number of cases used in the analysis. I call this the percent error. It represents the proportion of serious errors likely to be made if this algorithm or equation were to be used on another similar sample of students. The lower the number, the better. A similar statistic could be computed and compared for each predicted factor range. The performance of any algorithm can be assessed in terms of the percent agreement and the percent error that it generates.

Summary and Conclusions Regarding the Prediction of Freshmen Grade Point Averages.

This analysis led to a better understanding of the accuracy of the predictions currently made using quantitative admissions predictors. By showing how accuracy varies with the FGPA range, admissions officers know how much confidence they can attach to the predictions in the various FGPA ranges. Interestingly, when a comparison was made of the existing equations with new ones estimated on more recent data, the use of percent error showed that although by conventional measures of predictive accuracy the new equations fit the data better, the gains to be had would come at the cost of somewhat higher percent errors. This suggests that although we could predict closer to the actual performance on average, a relatively larger number of serious errors occurred with the newer algorithms. The analysis provided significant information about the costs and benefits of adopting new equations.

Table 1.

Observed Frequencies

Freshman GPA

		0-2	2.0-2.5	2.5-2.75	2.75-3	3.0-3.25	3.25-3.5	3.5-3.75	3.75+	Total
	0-2.00	5	3	0	3	0	4	1	2	18
	2.00-2.50	40	50	33	19	22	8	3	1	176
Predicted GPA	2.5-2.75	94	155	104	111	86	40	27	10	627
	2.75-3.0	70	125	78	103	110	82	56	36	660
	3.0-3.25	17	29	29	40	50	60	36	28	289
	3.25-3.5	4	6	4	7	9	22	9	13	74
	3.5-3.75	2	1	0	0	2	1	0	5	11
	3.75+	1	1	1	1	1	0	0	0	5
	Total	233	370	249	284	280	217	132	95	1860

Table 2.

Error Weights

Freshman GPA

		0-2	2.0-2.5	2.5-2.75	2.75-3	3.0-3.25	3.25-3.5	3.5-3.75	3.75+
	0-2.00	0	0	0	0.25	0.5	0.5	0.5	0.5
	2.00-2.50	0	0	0	0.25	0.5	0.5	0.5	0.5
Predicted GPA	2.5-2.75	0.75	0.25	0	0	0.25	0.25	0.25	0.25
	2.75-3.0	0.75	0.5	0	0	0.25	0.25	0.25	0.25
	3.0-3.25	1	0.75	0.25	0.25	0	0	0	0
	3.25-3.5	1	0.75	0.5	0.5	0	0	0	0
	3.5-3.75	1	0.75	0.5	0.5	0	0	0	0
	3.75+	1	0.75	0.5	0.5	0	0	0	0

Table 3.

Error Scores

Freshman GPA

		0-2	2.0-2.5	2.5-2.75	2.75-3	3.0-3.25	3.25-3.5	3.5-3.75	3.75+	Total
	0-2.00	0	0	0	0.75	0	2	0.5	1	4.25
	2.00-2.50	0	0	0	4.75	11	4	1.5	0.5	21.75
Predicted GPA	2.5-2.75	70.5	38.75	0	0	21.5	10	6.75	2.5	150
	2.75-3.0	52.5	62.5	0	0	27.5	20.5	14	9	186
	3.0-3.25	17	21.75	7.25	10	0	0	0	0	56
	3.25-3.5	4	4.5	2	3.5	0	0	0	0	14
	3.5-3.75	2	0.75	0	0	0	0	0	0	2.75
	3.75+	1	0.75	0.5	0.5	0	0	0	0	2.75
										437.5

HAS THE MIDDLE CLASS BEEN PRESSURED MOST
WHEN PAYING FOR HIGHER EDUCATION?
MORE EVIDENCE

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BACKGROUND

To researchers in financial aid for higher education, it is most significant and intriguing to investigate how the rapidly increasing costs of higher education, particularly at private colleges, have been affecting different socio-economic segments of the population.

The growth in tuition and fees at private colleges has outpaced inflation for the ninth consecutive year. The increases announced this spring have ranged from about 7 to 15 percent, while the rate of inflation has been 4.4 percent for the last two years (Carmody, 1989). Cornell University, for example, has increased the 1989-90 tuition rate for the endowed colleges by 6.9 percent, raising it to $14,000.

Aid to finance higher education, however, has been making rather slow progress in the last decade. Total financial aid amounted to over $24.5 billion in 1987-88, 6.5% more than at the beginning of the decade. This growth came primarily from increased student borrowing, while the contribution from grant programs (federal, state, and institutional grants combined) declined by 10.4% between 1980-81 and 1987-88, after adjusting for inflation (Lewis, 1988).

The increasing discrepancy between the rapid growth in tuition and the slow progress in public grant assistance has increased pressure on family contributions and student borrowing. In the fall of 1987, the Financial Aid Office of Cornell University conducted initial research on parental contributions, comparing the data of undergraduate dependent financial aid recipients at Cornell in academic years 1984-85 and 1987-88. The study analyzed three major components (total income, assets and the number of children in college) and how they affected parental contributions (PCs) to higher education. The results indicate that all income groups, except the lowest and the highest income categories, experienced significant increases in PCs between the two academic years after adjusting for inflation. When the covariates, the number of children in college per household and contributions from assets were controlled for, the study found: (1) families with over $50K income no longer demonstrated highly significant differences in PCs, indicating the increment in PCs can be attributed to a decrease in the number of children in college and/or an increase in PCs from assets; (2) in contrast, families with $10K-40K income did not show highly significant growth in contributions from assets, but instead demonstrated a substantial change in PCs mainly from income; and (3) most importantly, families with $40K-50K income experienced a significant decrease in the number of children in college, an increase in PCs from assets, and still demonstrated a significant increase in PCs between the two years even after controlling for the number of children in college and assets. The authors have concluded that middle income families ($40K-$50K) have endured the most pressure in paying for their children's college education (Mulugetta and Saleh, 1988).

PURPOSE OF THE STUDY

This study is an extension of the Cornell study described above. The study primarily addresses the following three questions:
1) In recent years, has there been any significant shift in the socio-economic composition of the student financial aid population at prestigious private institutions?
2) Can we find more evidence to confirm that the middle income group has been experiencing the greatest pressure to pay parental contributions, in comparison to other socio-economic segments of population?
3) Can we find any evidence to support the hypothesis that the enrollment of middle income students may have significantly declined at prestigious private colleges due to their financial pressure?

DATA SOURCES

Three prestigious private universities, one from the Midwest region and two from the Northeast, have participated in the parental contribution study funded by NASFAA (National Association for Student Financial Aid Administrators). The study has analyzed financial aid recipients, who were determined by the institution to be financially dependent on their parents, during academic years 1984-85 and 1987-88. For this paper, we present analysis results of Cornell University only. The following six variables were examined:
1) Parents' total taxable income, which includes:
adjusted gross income; social security income; aid to families with dependent children; other nontaxable income; IRA/KEOGH; tax deduction for working couples; and non-custodial parent's income if the institution includes non-custodial parent's income into the PC calculation.
2) Parents' total assets, which includes:
cash in bank; home equity; other real estate/investments; and adjusted business/farm worth.
3) Parental contributions to their child's education as determined by the institution. This may differ from originally computed parental contributions reported on FAFNAR (Financial Aid Form Need Analysis Report).
4) Parental contribution from income, which is calculated based on the need analysis formula in uniform methodology.

5) Parental contribution from assets, which is calculated based on the need analysis formula in uniform methodology.

6) Total number of children in college per household. First five variables were converted into constant dollars using a consumer price index of the current year as a base. This procedure has guaranteed that the two-year figures are comparable after controlling for the impact of inflation (Lanchantin, 1986).

CHANGE IN INCOME DISTRIBUTION OF FINANCIAL AID POPULATION AND DEFINITION OF "MIDDLE CLASS"

We first examine whether there has been any significant shift in the income composition of the student financial aid population at prestigious private institutions in recent years. Table 1 represents a distribution of dependent financial aid students across income strata. The academic year 1984-85 and 1987-88 figures are compared. The distribution of aid recipients across $20K-income increments has changed considerably between the two years, even after adjusting for inflation.

The number of aid recipients between the two years decreased from 3,184 to 3,042. The students with less than a $20K family income accounted for 20.9% of the dependent population in 1984-85, and it declined to 19.5% in 1987-88. The composition of the students from lower-middle income families ($20K to $40K) and those from middle income homes ($40K to $60K) also declined from 33.6% to 30.9% and from 29.3% to 27.7% respectively. In contrast, the proportion of the aid recipients with family incomes of over $60K significantly grew from 16.2% to 21.9% (Table 1).

For the purposes of this study, when using the term "lower-middle" income group, we are referring to families with annual incomes of more than $20K and less than $40K. Similarly, the "middle income group" refers to families with incomes more than $40K and less than $60K. The subsequent analyses will be focused on whether the lower-middle or the middle income group have been experiencing greater pressure to pay parental contributions in comparison to the other income groups.

ANALYSIS OF PC CALCULATION PROCEDURE

It is useful to examine first how parental contributions are calculated on the basis of the need analysis formula in uniform methodology. The parental contribution (PC) to a student's education is computed based on three major elements: income, assets and the number of people in college per household.

Total family income is the sum of taxable and non-taxable incomes. The total income less family expenses/allowances results in available income. The Available Income (AI) is the first major component of the PC calculation.

The second component is parental assets. Total assets include cash, savings and checking accounts, home equity, equity in investments, other real estate, and business or farm equity. The total parental assets are then used to compute the Income Supplement (IS), which is a percentage of the total assets after an asset protection allowance is subtracted. Available Income (AI) and Income Supplement (IS) are added together to derive the parents' Adjusted Available Income (AAI). Total parental contribution to education is a certain percentage of adjusted available income.

Finally, the contribution for each student is computed by dividing the total contribution by the number of people in college per household. This procedure is summarized in Equation 1.

$$\text{Calculated PC} = \% \, (A\,I + I\,S) \, / \, \# \text{ of People in College} \; \ldots\ldots \; (\text{Eq.1})$$

In most cases, private schools do not automatically use PCs calculated by the formula. In fact, most of the financial aid offices at private institutions make some institutional adjustments to determine adjusted parental contributions. Institutional adjustments occur in both routine as well as ad hoc manners. Routine adjustments may include such calculations as: adding back business loss figures into income; adding non-custodial parental income; subtracting the number of parents in college from the number of family members in college, etc. Ad hoc adjustments usually occur in response to individual appeals. Financial aid officers adjust the amount of parental contributions, based upon their professional judgment, in response to unforseen changes in family financial situations, such as the sudden death of a head of household. Equation 2 illustrates this procedure.

$$\text{Adjusted PC} = \text{Calculated PC} \pm \text{Institutional Adjustments} \; \ldots\ldots\ldots \; (\text{Eq.2})$$

Keeping the formulas described above in mind, let us explain the model used to analyze the parental contribution data.

MODEL AND RESULTS PART I: CALCULATED PC FROM INCOME

The main task of this study is to investigate whether the lower-middle and the middle income group has been experiencing greater pressure to pay parental contributions in comparison to the lower income, or the upper-middle income groups. How can we measure "pressure" from paying parental contributions then? To measure "pressure" requires several stages of data conversion. Let us take an example of contribution from income (INCOME PC). First, if a family has more than one child in college, the PC from income is multiplied by the number of children in college per household. This computes total parental contribution from income for higher education per household. Then, the ratio of total INCOME PC to total income is calculated by simply dividing total INCOME PC by total income. This new variable is the RATIO PC/INC. The RATIO PC/INC indicates what percentage of total income is spent for higher education per household. "Pressure" is then measured by how much change occurs in the RATIO PC/INC when income increases by one dollar. In other words, we are interested in investigating to what degree the share of PC in total income changes as total income increases by one unit. Our analysis is centered upon whether lower-middle or middle income families experience a greater change in the RATIO PC/INC, in accordance with one unit dollar increase in income, compared to other income families. The model is expressed as a linear function:

$$Y = A + B1D1 + B2D2 + B3D3 + B4X + B5(D1*X) + B6(D2*X) + B7(D3*X) \,..\, (\text{Eq.3})$$

Where:

Y = RATIO PC/INC (Total amount of PC from income/ income)

A = Intercept

D1 = a dichotomous variable assigning 1 to the low income group and 0 to other groups

D2 = a dichotomous variable assigning 1 to the lower-middle income group and 0 to other groups

D3 = a dichotomous variable assigning 1 to the upper-middle income group and 0 to other groups

X = Total annual income

D1*X ... D3*X = Interaction terms

B1 ....B7 = Regression beta coefficients

The first PC component examined here is calculated parental contribution from income. As noted earlier, PC from income is a direct outcome from the need analysis formula and does not include institutional adjustments. If the middle income group encounters a greater change in the RATIO PC/INC per dollar income increment than do the other groups, we expect to observe statistically significant, negative beta coefficients associated with D1*X, D2*X and D3*X. When 0 and 1 values are appropriately inserted in the equation, we obtain four different regression equations, one for each income group. Our analysis is centered upon whether the slope coefficient of the regression line for the middle income group is significantly higher than the other slope coefficients. The regression model was run against the 1984-85 and the 1987-88 data. The data points with Cook's D statistics larger than .01 were identified as outliers, and discarded from the analysis.

The summarized results of regression analysis are presented in Table 3 and in Figure 1. The results are quite interesting and revealing. The four regression lines depict an interesting S shape as seen Figure 1. When income is less than $20K, Y value (RATIO PC/INC) increases rather slowly. Then Y value rises quite rapidly until income reaches a level of $60K. After this, the increment of RATIO PC/INC slows down again. An almost identical S shape figure appeared when the 1987-88 data was analyzed.

A closer examination of the regression equations will be helpful (See Table 3 a). For low income families (0-$20K), the estimated increase in the RATIO PC/INC per $1 income increment is .000109%, which is equivalent to .109% change per $1000 income increase. The regression equation estimates, for example, that a family with an income of $10,000 contributes about .977 of their income (=$97.7) and when that income increases by $1,000, the family is expected to contribute 1.09% of their income ($119.4) for college education.

For the lower-middle income group, the estimated growth in the RATIO PC/INC per $1,000 income increase is surprisingly high, .316%. A family with an income of $30K is, for example, expected to spend about 7.05% of income (=$2,115) for education; with a $1,000 salary increase, their total contribution for education becomes 7.366% of their income (=$2,283). Similarly, the growth rate in RATIO PC/INC per $1,000 increase in income is .188% for the middle income group, which expects a family with an income of $50K to contribute 12.47% of their income (=$6,236) and add .188% more as the income grows by $1,000. This heavy levying continues until the income level reaches around $60K.

For upper-middle income families, the increment rate of RATIO PC/INC per $1,000 increase in income is surprisingly small, .050. It is anticipated that parents with $70K incomes will spend 15.247% of their total earnings for their children's education ($10,673) and add only .050% more as their income rises by $1,000.

The families with the incomes of $20K to $60K in general, those with the incomes of $20K to $40K in particular, endure greater "pressure" when paying for college education than low or upper-middle income families. A similar trend was observed when the 1987-88 data was analyzed. The model also fits well the data from the other two universities, and the results have shown a similar S-shape trend (the results are not presented in this paper).

In conclusion, the overall results have revealed that the need analysis formula to calculate PC from income functions most favorably for upper-middle families with over $60K income, while it seems to work least favorably for lower-middle ($20K-$40K) and middle income ($40K-$60K) groups. For the latter two groups, as income increases, corresponding growth rate of the share of PC from income is significantly larger than that of the wealthiest group and that of the least wealthy group.

RESULTS PART II: CALCULATED PC FROM ASSETS

A second PC component examined in this study is calculated parental contribution from assets. A similar regression model was run, using the RATIO PC/ASSET as a dependent variable (Y) and total assets as an independent variable (X). The RATIO PC/ASSET, analogous to the RATIO PC/INC, is computed by dividing total contribution from assets by total assets. Three dichotomous variables are used again to form four groups: the group with low assets of $0-$30K; the lower-middle group with $30K-$60K, the middle with $60K-$90K and the upper-middle strata with over $90K in assets. The model examines how much increase in RATIO PC/ASSET is expected per one dollar increment in assets across different groups.

The results of the regression analysis are summarized in Table 5 (a) and (b) and in Figure 2. Again we have found a notable S-shape relationship between X and Y in all data sets. With assets less than $30K, increase in Y value (the RATIO PC/ASSET) is close to 0. Then Y value rises quite sharply as X (total assets) increases up to the level of $90K. After that, the growth rate of the RATIO PC/ASSET becomes significantly small again.

Let us closely examine the regression equations presented in Table 5(a). For the low asset families (0-$30K), the estimated increase in the RATIO PC/ASSET per $1000 asset increment is .004%.

For the lower-middle asset group ($30-60K), however, the estimated growth in the RATIO PC/ASSET per $1000 asset increase is .060%. A family with assets of $40K is, for example, expected to spend about .627% of their total assets (=$251) for education. With a $1000 asset increase, total contribution for education becomes .687% of their total assets

(=$282). A similar calculation is applied for the middle asset group. The growth rate in RATIO PC/ASSET per $1000 increase in asset is .044 and the equation estimates that a family with $80K in assets contributes 2.524% of their assets (=$2,019) and adds .044% more as their assets grow by $1,000.

For upper-middle income families, the increment rate of the RATIO PC/ASSET per $1000 increase in assets is .01%. It is anticipated that parents with $120K in assets will spend 3.288% of their total assets for higher education (=$3,946) and as assets rise to $121K, total PC from assets becomes 3.30% of the total assets (=$3,991).

The data from the other two universities have shown quite similar S-shape trends and regression results. Families with $30K-90K assets in general, and families with $30K-60K assets in particular, actually face the greatest "pressure" when paying PC from assets, in comparison to other families.

The overall results presented up to this point have implied that the need analysis formula in uniform methodology functions at greatest advantage for upper-middle families earning over $60K income and possessing more than $90K in assets, whereas it seems to work disadvantageously for families who earn $20K-$60K income and possess $30K-90K in assets.

SUMMARY AND CONCLUSION

The American higher education system is currently enduring great pressure from rapidly increasing college costs. Consequently, financial aid is the most powerful vehicle to create an equal opportunity for all members of the society, regardless of their socio-economic backgrounds, to obtain access to higher education. Financial aid must function in an impartial manner so that limited financial resources will be fairly distributed, according to the degree of financial need.

This study has examined the fairness of the need analysis formula to calculate parental contributions (PC) on the basis of parental income and assets. The data collected from three prestigious, private institutions conclusively indicate that middle income families with incomes of $20K-$60K (with incomes of $20K-$40K in particular) and with assets of $30K-$90K (with assets of $30K-$60K in particular) endure the greatest pressure when paying for higher education, in comparison with other groups. This is because among these families, as income increases, corresponding growth ratio of PC to total income (or assets) is significantly larger than that of lower income or upper-middle income families.

The analysis has also revealed that the enrollment of middle income families in these institutions has significantly declined in recent years. Particularly, lower-middle income families with incomes of $20K-$40K, who endure the greatest pressure from paying for higher education, have experienced the largest decline in the enrollment.

Can we state that the enrollment of middle income students have significantly declined at prestigious private colleges due to their financial pressure? This paper has not yet clarified a causal link between the declining enrollment and the degree of financial pressure. In order to clarify this causal link, we must wait the analysis of questionnaire survey data on why a number of accepted students decide not to enroll in prestigious, private institutions and choose to go elsewhere.

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TABLE 1

DISTRIBUTION OF DEPENDENT AID RECIPIENTS BY INCOME GROUPS

Income	1984-85 #	1984-85 %	1987-88 #	1987-88 %	Change 87-84
0-20K	666	20.9%	592	19.5%	-1.4%
20K-40K	1069	33.6%	939	30.9%	-2.7%
40K-60K	933	29.3%	844	27.7%	-1.6%
Over 60	516	16.2%	667	21.9%	5.7%
Total	3184	100%	3042	100%	

TABLE 2

AVERAGE CALCULATED PC FROM INCOME BY INCOME GROUPS

	1984-85			1987-88		
Income ($)	MEAN ($)	STD	(N)	MEAN ($)	STD	(N)
0-20K	146.7	366.3	(660)	211.1	641.4	(588)
20K-40K	1706.5	1506.2	(1069)	1784.3	1481.6	(939)
40K-60K	4204.1	2446.7	(933)	4745.2	2648.1	(844)
Over 60	6051.0	3011.8	(516)	6738.1	3793.7	(666)
Total	2821.2	2859.6	(3178)	3388.9	3403.2	(3037)

REGRESSION ANALYSIS RESULTS
DEPENDENT VARIABLE: TOTAL CALCULATED PC FROM INCOME / INCOME

TABLE 3 (a): 1984-85

Independent Variables	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob.>[T]
Intercept	3.071406	1.515898	2.03	0.0428
D1	-3.184859	1.625654	-1.96	0.0502
D2	-5.501545	1.761239	-3.12	0.0018
D3	8.675142	2.111401	4.11	0.0001
Income	0.000188	0.000030	6.19	0.0001
D1*Income	-0.000079	0.000052	-1.51	0.1322
D2*Income	0.000128	0.000042	3.03	0.0024
D3*Income	-0.000138	0.000036	-3.81	0.0001
R-Square	0.4601			
N of Obs.	3178			

Low Income Group [$0 - $20K] Y = -0.1135 + 0.000109 X1
lower-Mid. Group [$20 - $40K] Y = -2.4301 + 0.000316 X1
Middle Group [$40 - $60K] Y = 3.0714 + 0.000188 X1
Upper-Mid. Group [> $60K] Y = 11.7465 + 0.000050 X1

TABLE 3 (b): 1987-88

Independent Variables	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob.>[T]
Intercept	1.918881	1.967856	0.98	0.3296
D1	-1.440232	2.083152	-0.69	0.4894
D2	-2.428008	2.272948	-1.07	0.2855
D3	13.862600	2.321083	5.97	0.0001
Income	0.000225	0.000040	5.69	0.0001
D1*Income	-0.000114	0.000064	-1.77	0.0768
D2*Income	0.000045	0.000054	0.82	0.4107
D3*Income	-0.000228	0.000043	-5.37	0.0001
R-Square	0.3755			
N of Obs.	3037			

Low Income Group [$0 - $20K] Y 0.4786 + 0.000111 X1
Lower-Mid. Group [$20 - $40K] Y -0.5091 + 0.000269 X1
Middle Group [$40 - $60K] Y 1.9189 + 0.000225 X1
Upper-Mid. Group [> $60K] Y 15.7815 + -0.000004 X1

Figure 1

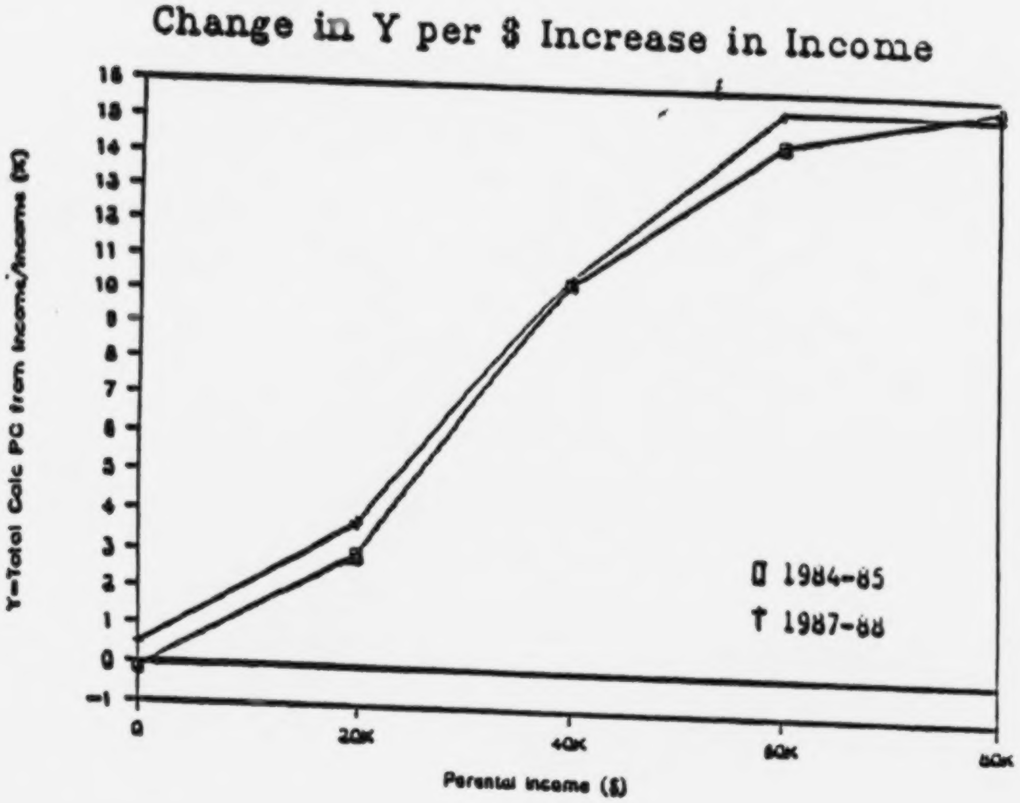


TABLE 4

AVERAGE CALCULATED PC FROM ASSETS BY ASSET GROUPS

	1984-85			1987-88		
INCOME ($)	MEAN ($)	STD	(N)	MEAN ($)	STD	(N)
0-30K	4.5	31.3	(843)	2.2	20.5	(883)
30K-60K	358.3	374.4	(813)	353.8	370.7	(644)
60K-90K	1130.1	688.9	(733)	1218.8	670.9	(624)
Over 90K	2941.7	1749.8	(791)	3288.9	2121.0	(886)
Total	1085.0	1486.3	(3180)	1285.6	1807.9	(3037)

REGRESSION ANALYSIS RESULTS
DEPENDENT VARIABLE: TOTAL CALCULATED PC FROM ASSETS / ASSETS

TABLE 5 (a): 1984-85

Independent Variables	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob.>[T]
Intercept	-0.995853	0.214248	-4.65	0.0001
D1	0.984709	0.216332	4.55	0.0001
D2	-0.777258	0.250436	-3.10	0.0019
D3	3.083916	0.228039	13.52	0.0001
Assets	0.000044	0.000003	15.01	0.0001
D1*Assets	-0.000040	0.000004	-10.93	0.0001
D2*Assets	0.000017	0.000004	4.09	0.0001
D3*Assets	-0.000034	0.000003	-11.32	0.0001
R-Square	0.8041			
N of Obs.	3180			

Low Assets Group [$0 - $30K] Y = -0.0111 + 0.000004 X1
Lower-Mid. Group [$30 - $60K] Y = -1.7731 + 0.000060 X1
Middle Group [$60 - $90K] Y = -0.9959 + 0.000044 X1
Upper-Mid. Group [> $90K] Y = 2.0881 + 0.000010 X1

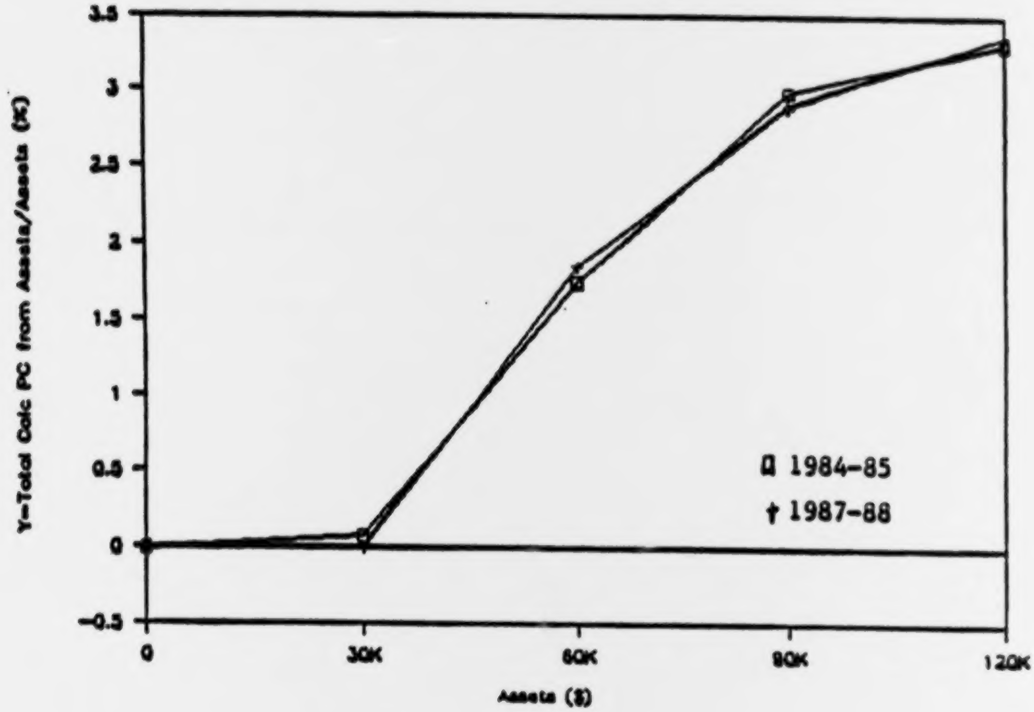
TABLE 5 (b): 1987-88

Independent Variables	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob.>[T]
Intercept	0.399881	0.252203	1.59	0.1129
D1	-4.076501	0.254359	-1.60	0.1091
D2	-1.904385	0.296446	-6.42	0.0001
D3	1.875662	0.261791	7.16	0.0001
Assets	0.000025	0.000003	7.48	0.0001
D1*Assets	-0.000023	0.000004	-5.50	0.0001
D2*Assets	0.000029	0.000005	6.06	0.0001
D3*Assets	-0.000016	0.000003	-4.76	0.0001
R-Square	0.7364			
N of Obs.	3036			

Low Assets Group [$0 - $30K] Y = -3.6766 + 0.000002 X1
Lower-Mid. Group [$30 - $60K] Y = -1.5045 + 0.000054 X1
Middle Group [$60 - $90K] Y = 0.3999 + 0.000025 X1
Upper-Mid. Group [> $90K] Y = 2.2755 + 0.000009 X1

Figure 2

Change in Y per $ Increase in Assets



A Case Study of Technological
Support for Institutional Research
at a Small College

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Institutional research in small institutions is undertaken with little staff or budgetary support. As a result, very little research is done beyond the collection, analysis and reporting of registrar's data. Even this kind of research can be overwhelming if the policy issues to be addressed by the analysis are sufficiently complex.

In this paper, I present a case study of how an institutional research office in a small college (headcount enrollment of under 600 students) dealt with this problem. I relate how the institutional research office worked with the financial aid office at the college to collect and analyze survey and institutional data on a decade's worth of graduates. A necessary element of the project was the use of an integrated software package for a microcomputer.

At the time of the study, institutional research at the college was the responsibility of a Director working one-half to three-quarters time, with no additional staff. The tradition of the office was to complete IPEDS reports and other questionnaires, respond to a variety of requests for institutional data and collect faculty workload statistics. Except for the occasional ad hoc call to other institutions for some comparative data on a special issue, this was the extent of the research done through the office.

The Director of Institutional Research and the Director of Financial Aid agreed to replicate a survey of student attitudes toward educational loan debt done at another institution with which the Director of Financial Aid had been associated. The object of the survey research was to determine what kind of attitudes graduates and former students had toward the student loan debts they had assumed while enrolled at the college. The administration of the college believed that this research would inform decisions about financial aid policy. The directors of financial aid and institutional research also believed it would add to research already done on attitudes toward student loan debt.

Agreement to undertake the research and planning for the project were completed during the spring term. It was agreed to survey all graduates or former students at the college who had borrowed over $2,500 in student loans during the period from 1978-79 to 1987-88. During the summer, a work-study student collected student data from the records in the financial aid office and entered this data for each student into a simple data-base created using the data-base component of the software package. The items included in this data file were the student's name, social security number, student loan available to students at the college. A survey identification number was also assigned to each student, and used to match records from this data file with records in other data files used during the course of the research while assuring confidentiality.

The integrated software package used was Microsoft's "Works" for the Apple MacIntosh. "Works" is also available for IBM PC's and PC compatible microcomputers. Staff in both offices found both the hardware and software easy to work with even though neither staffs had used the software before. Additionally, since both offices had the hardware and software in common, it was much easier to share disks with files and data. The package integrates four software components, and each component was used in the research project. The four components, and their application in the project, are:

1) a word-processing program: This component was used to prepare cover letters, and to lay out, edit and print the questionnaire itself. The third page of the questionnaire, which illustrates the line drawing capability of the program and its utility in questionnaire layout, is included as exhibit #1. This component was also used to store and edit reports for presentation. Tables prepared using the spreadsheet component were copied into word-processing files and edited for inclusion in reports of the research.

2) a data-base program: Institutional data from financial aid records was recorded in one data-base as described above. Response data was entered in a separate data-base with the help of a work-study student assisting the director of institutional research. The data-base program was used to compile summaries of the responses. These summary statistics were then electronically copied into spreadsheets and word-processing files that were reproduced as tables in reports of research findings. Although not used in this project, the data-base component can be used with the word-processing program to generate address labels and personalized correspondence which typically enhances the response rate for surveys.

3) a spreadsheet program: Rudimentary analyses of the institutional and response data were performed using spreadsheets. Summary data files were copied from the data-bases and into spreadsheets to calculate averages and other statistical measures. The spreadsheet component also incorporated charting and limited graphics capabilities which did enhance the reporting of information based on the research.

4) a communications program: Although not used in this particular project, data from the college's automated student record system running on a mainframe computer can be downloaded into files that can be copied into specially constructed data-bases. This capability could have been used to further analyze the response data by comparing attitudinal data with data from the student's academic record to determine whether there was a correlation between academic program and the student's attitude toward educational loan debt.

This project would not have been undertaken if both offices did not have access to the integrated software package and the hardware on which to run the software. This feature of the computing equipment environment of the college was crucial to the success of this project. Virtually all administrative offices on campus have access to microcomputers on which to run this software. This compatibility between offices is crucial if the kind of joint institutional research projects illustrated in this case study are to be successful.

Some of the advantages and disadvantages of an integrated software package are:

a) The economy of an all-in-one package when compared to the cost of purchasing each component separately is an advantage.

b) To be weighed against this is the fact that each component in the integrated package is not as powerful as if the components were purchased separately.

c) You are forced to go with those components that come with the package. For example, there is no statistical analysis software as part of the "Works" package, and this, in particular, would be a desirable piece of software for an institutional research office.

d) It is easy to transport files from one component to another. Charts created using the spreadsheet component can readily be copied into a report done with the word-processing component. Data-base files can be copied to spreadsheets and spreadsheet files copied into data-bases. For example, in our research project, we initially coded responses as alphabetic characters; when analyzing the data, it was deemed helpful to have a numeric measure of the respondent's overall attitude toward loan debt. This transformation and the necessary calculations were made possible by being able to copy the response data into a spreadsheet, re-code the alphabetic responses as numeric responses based on a scale, calculate the associated numeric measure of over-all attitude toward loan debt and then copy each respondent's calculated measure back into the data-base as a new item. No re-keying of responses was necessary; only the capability to transport files between the two components and to sort files within the spreadsheet and the data-base.

The research yielded information which supported financial aid planning, and the skills learned were extremely helpful as the institutional research office was able to support research projects on other topics, such as student attrition ant trends in faculty workload.

As a result of this experience with computer-assisted institutional research, I would make the following observations:

1. If you are undertaking this kind of research at a small college, you will very likely be the pioneer. If you find yourself in the position of having to advocate computer support for institutional research at your institution, then probably no one else has ever done it. As a consequence, choose hardware and software that you feel you can work with on your own. I recommend choosing the kind of microcomputer that is most popular among computer users on your campus. They will be the people you turn to first for help.

2. Enlist a research partner. Find other offices that would like to

do some kind of research but "just don't have the time." Propose a joint effort. One advantage is that the workload is shared and scarce resources are pooled. But there is a more important advantage. Instead of having a research project imposed on you that lacks sufficient focus, you will find that the joint effort tends to sharpen the focus of the research as the principal user of the information (your research partner) has invested time and effort in the acquisition of information.

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ENVIRONMENTAL SCANNING NETWORKS:

A COLLABORATIVE APPROACH TO STRATEGIC PLANNING

> "Strategic planning looks outward and is focused on keeping the institution in step with the changing environment...and because the external environment is in constant flux, strategic planning must be continuous, pervasive, and indigenous, not a blueprint or the work of a planning officer" (Keller, 1983, p. 145).

Most organizations have some form of management information system to support planning, control and evaluation. However, these formal systems are usually limited to data on the organization's internal indicators, with perhaps some information on peers or competitors. This "inside-out" perspective often overlooks emerging external issues which may have an even greater impact on the future of the organization than any of the internal factors.

This paper presents a framework for developing an environmental scanning information base on external trends and issues and discusses the sharing of this information in a collaborative process involving networks within and between organizations, using electronic files and computer conferencing applications.

Scanning and Planning: A Collaborative Process

Environmental scanning has been defined as "a kind of radar to scan the world systematically" (Brown and Weiner, p. ix, 1985). The scanning activity, with its focus on factors external to the organization, is one important element that separates strategic planning from more conventional long range and operational planning. This process helps the organization clarify issues and assess the impact of political, economic, social and technological trends and anticipated future events (Bryson, 1988).

We define collaboration as "a process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible" (Gray, 1989, p. 5). Collaboration allows parties who have a stake in the future of the organization to join forces, pool information, share perspectives and define the key issues to be addressed. We view strategic planning, in its most productive sense, as a collaborative process designed to create a shared vision of the organization. We feel that effective collaboration can begin with the environmental scanning function of strategic planning -- specifically the exchange of perspectives regarding the impact of external trends and events on the organization's future.

Environmental scanning, organizational assessment, mission, issues identification and analysis are usually seen as initial steps in developing a strategic plan. However, we view environmental scanning as an ongoing and continuous activity that can form the basis for developing effective changes in organizational policy and strategy. As depicted in figure 1, our model views scanning not as a one time "snapshot", but rather an ongoing and iterative process of issue definition and strategy formulation. From this perspective, scanning information is used at various stages of the strategic planning process. Issues are defined and redefined, strategies are formulated and reformulated based upon ongoing collaborative assessment of the organization's performance in meeting environmental opportunities and threats.

Organizing for Environmental Scanning

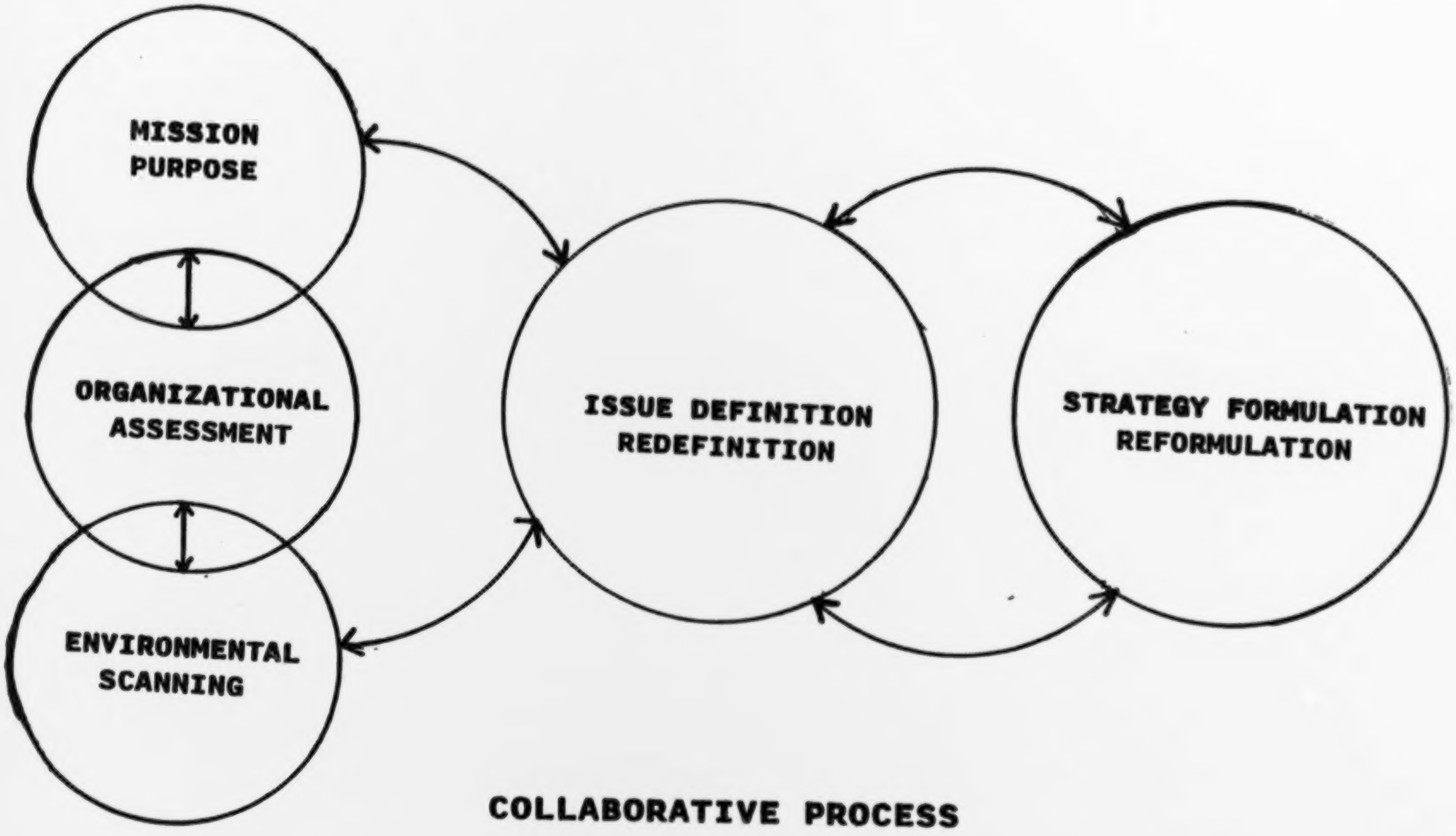
Given the wide range of sources and perspectives, the process of information collection alone presents significant challenges. There is always a danger of gathering information that is extraneous or of questionable relevance. Further, information overload can easily lead to "analysis paralysis," where scanning assessments actually hinder strategic thinking. This section presents a five part framework for managing the scanning and analysis activity for an institution, using collaborative processes, issues analysis techniques and information technology.

(1) Appoint an Environmental Scanning Committee. According to Morrison, (1986) the most popular way to implement a formal scanning system is through the establishment of an in-house, interdisciplinary committee. The chair of this committee is often a trusted and respected advisor to the President or the chief academic officer. For colleges and universities, representation should probably include a cross section of faculty, department heads, vice presidents and directors. The size of the committee will vary depending on the organization and the degree of representation desired. However, to keep the group dynamics manageable and focused, it should probably not exceed 10-12 members. Although the committee could be supported by institutional research and planning staff, the analysis scanning of trends would be done by the committee.

(2) Define Strategic Issues. An initial task of the committee would be to define the key issues facing the organization. Strategic issues are those that represent "fundamental policy choices affecting an organization's mandates, mission, values, product or service level and mix, clients or users, cost, financing, organization, or management" (Bryson, 1988, p. 139). The important point here is that trends affect organizations in different ways depending upon considerations related to mission, goals and resources. The committee needs to be selective in defining strategic issues and the categories of information to be collected (political, economic, social, technological, etc). After defining the issues, the environmental scanning committee would, on an ongoing basis, review new trend information and analyze the impact of the trend on the institution. Scanning, issue identification and impact analysis is an iterative process since the framing of the strategic issue can guide the collection of additional information and analysis.

Figure 1

STRATEGIC PLANNING


MISSION
PURPOSE
ORGANIZATIONAL
ASSESSMENT
ENVIRONMENTAL
SCANNING
ISSUE DEFINITION
REDEFINITION
STRATEGY FORMULATION
REFORMULATION
COLLABORATIVE PROCESS

Strategic issues and scanning information for an institution of higher education might be organized as follows:

Environmental Context/Trend	Strategic Issue
Demographics - declining high school graduates	How will the institution recruit and retain students, specially older students?
Political - declining federal support to higher education	How can the institution increase its funding from other sectors?
Economic - state-wide growth in the economy	What is the institution's role in fostering economic development?
Technological - advances in use of computer aided instruction; use of technology in the workplace.	How will the institution respond to changing technology?
Social/Cultural - changing ethnic populations; increasing incidents of racism/sexism on campus; increase in dual career couples.	What is the role of the institution in promoting diversity and equity?

(3) Appoint and Train Environmental Scanning Coordinators. Once the committee is in place and key strategic issues have been identified, individuals need to continue and expand the scanning activity. The outcome of this effort should be the production of abstracts and issue briefs. At Penn State Delaware County, an Environmental Scanning Project (ESP) has been ongoing for the last two years. One individual serves as coordinator, assisted by volunteer faculty and staff assigned to scan specific sources and topics. Although this effort has produced valuable information to support campus strategic planning, it has been difficult to maintain the interest and enthusiasm of campus volunteers.

One way to support individual scanners would be to limit the topic area or theme of responsibility and to publish the submitted abstracts in periodic newsletters. In addition, scanners could form inter or intra-institutional networks, with periodic meetings for information exchange and professional development. For example, for the last several years, the Association for Institutional Research (AIR) and the Society for College and University Planning (SCUP) have sponsored an environmental scanning session at their annual meetings.

(4) Use Technology to Form the Information Database. The environmental scanning committee establishes the parameters for the information base while the scanning coordinators obtain and abstract the trend information. The scanning committee reviews the abstracts before they are entered into an information base. Considerable time can be saved and a more thorough scan can be undertaken through the use of electronic scanning networks. The use of computer files facilitates the review, retrieval and updating of the information base. Electronic technology is also a useful tool in increasing

communication between units within an institution and allows for greater opportunities for the exchange of information between organizations.

(5) Analyze and Interpret Scanning Information. While scanners provide abstracts of information, the environmental scanning committee is responsible for guiding the interpretation and analysis of these trends, with staff support for more detailed analysis work. The key to this step is developing a consensus of the potential impacts of the trend on the organization and listing alternative strategies and policy options for consideration. A variety of group decisonmaking techniques can be used to develop forecasts and scenarios (e.g., delphi, nominal group, cross impact, etc.)[1].

The environmental scanning system should be regularly updated with information and analysis. Issues may be redefined and strategies reformulated based upon the results of the environmental analysis. One means of accomplishing this task is to publish periodic newsletters and issue reports of the most relevant trend information. Scanning coordinators could be encouraged to contribute to institutional newsletters and author special issue papers.

Scanning Networks

Scanning networks can be composed of: (1) strategic planning units within a single institution (e.g., various offices or campus locations); (2) a group of institutions located within the same geographic area (e.g., the Oregon Environmental Scanning Consortium); or (3) institutions sharing common missions or programs (e.g., a state system of higher education).

Environmental scanning networks are often informal in nature but can function as mini professional associations. Individuals who perform or coordinate the scanning activity meet periodically, share information, and reinforce the notion that scanning is important to effective strategic planning and management. Professional associations such as AIR and SCUP also help to create broader networks by sponsoring special sessions on environmental scanning. An environmental scanning consortium has been formed by 15 public and private institutions located in Oregon's Willamette Valley (Aspinwall-Lamberts and Ricks, 1989). Institutions of higher education have a long history of establishing data-sharing consortia on internal management indicators, such as the Association of American Universities Data Exchange which has been active since 1973 (Dunn, 1987).

In addition to informal consortia, the use of formal structured information sharing networks are emerging. The American Association of State Colleges and Universities and IBM have jointly sponsored the "Academic Environmental Scanning Project" which will be discussed in more detail later in this paper. In addition, the United Way of America has recently updated its national environmental scanning database. Many Universities have used this database. For example, Michigan State University developed a reciprocal arrangement with its local United Way Agency and contributed information in exchange for free access to the national database (Morrison, 1986).

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[1] For a complete discussion of these analysis techniques see Morrison, J., et.al., Futures Research and the Strategic Planning Process: Implications for Higher Education (1984).

The potential exists for continued collaboration to facilitate the collection and analysis of scanning information. The use of electronic files and computer conferencing will make it easier to develop and maintain these relationships. These collaborative networks are effective ways to enrich the environmental scanning process, as the following case study illustrates.

The AASCU/IBM Project

The American Association of State Colleges and Universities (AASCU) has recently established an environmental scanning network for its members.[2] It was developed in response to a growing concern by presidents who felt the need to be more aware of major external issues and their implications for public higher education. They called upon AASCU to institute a broad gauged information service relating overarching national concerns to their particular academic environments. While the scanning network is targeted to presidents and academic vice presidents, users include directors of planning and institutional research.

Here's how it works. Member schools are asked to conduct environmental scanning activities by monitoring books, newspapers, and periodicals to identify current social, technological, economic, and political issues that impact public higher education. Scanners write brief abstracts and transmit them to the host computer at AASCU via the People Sharing Information Network (PSINET) developed by IBM. Using a modem and IBM software, users may "join" conferences, individual sessions within conferences, submit and receive abstracts or papers, and send and receive messages to users. The network, which is menu driven and user friendly, consists of 10 conferences, ranging from "Futures" to "Government Relations." Although each conference contains interesting and useful information for planning (e.g., government relations includes exchanges of information related to higher education and government such as the recent Governor's summit on education), the focus for environmental scanning is the "Futures" conference. Two sessions are directly related to environmental scanning -- "Abstracts" and "Assumptions."

The "Abstracts" session forms the basis of the environmental scanning project. Users who join the session may submit or receive scanning abstracts. Each abstract has been classified by scanning topic: finances, taxes, politics, policy, future, research, trends, ecology, economic conditions, political leaders, demographic changes, pending legislation, societal changes, planning, higher education, emerging issues, upcoming events, declining markets and growth markets. Citations are referenced by multiple topics. The analyses are compiled by AASCU and distributed in a newsletter to member schools.

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[2] For additional information about the AASCU project, contact Evelyn Hively, Vice President, Academic Programs for the American Association of State Colleges and Universities (202) 293-7070.

The "Assumptions" session also supports environmental scanning. Its primary function is for members to collaborate in the analysis of scanning abstracts. In addition, users may submit or receive more in-depth scanning analyses such as the paper "Societal Trends in Forming the Context for Long-Range Planning" by William Daehling, Academic Vice President, Lewis-Clark State College.

The scanning network began in April and to date has been subscribed to by more than 48 institutions, including Lock Haven University and Penn State University at Harrisburg. However, only a few schools are actively engaged in scanning activities. The majority of scanning "inputs" have been performed by central AASCU staff.

The advantages of participating in this network are numerous. It provides a "window" which allows the user to observe the discussions of leaders in higher education concerning a variety of merging issues. In addition it is more cost-effective than subscribing to or researching major journals. Finally, and perhaps most importantly, it facilitates the development of an institutional scanning information base. This last attribute may be the most valuable for small institutions with modestly staffed institutional research and planning functions. For Lock Haven University, the AASCU scanning information, analyzed and interpreted in the context of this institution's environment, will be used as part of its strategic planning process.

CONCLUSION

The focus of this paper has been on developing environmental scanning networks to support strategic planning. Scanning networks within and between organizations can be an efficient way of obtaining high quality information that helps to define key issues and develop strategy. As evidenced by the AASCU project, these networks can be enhanced through the use of electronic mail, file transfer and computer conferencing techniques.

We view the analysis of environmental scanning information as a collaborative and iterative process. This perspective on strategic planning presents challenges to the institutional researcher/planning officer who is often called upon to provide support to a committee's work. Collaboration usually produces more conflict than consensus in the early stages. Committees need to have a clear statement of purpose and adhere to guidelines and timeframes. The planning officer can assist the committee by offering perspectives gleaned from other institutions and by suggesting analysis techniques that help guide discussions toward recommended strategy. In addition, the institutional researcher/planning officer can serve effectively as a champion of the process by stressing the importance of environmental scanning analysis to effective strategic planning.

Sharing a common perspective on the environment challenges one to look outward, to see the big picture and be directed toward the future. While this perspective helps produce effective strategy and policy, it is also useful in the day-to-day management of the organization. Above all else, the environmental scanning process should help foster strategic thinking and managing.

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THE DEVELOPMENT OF A PERFORMANCE INDICATOR SYSTEM: A NEW DIRECTION FOR ENROLLMENT MANAGEMENT

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With the ever increasing emphasis on computer technology in the management decision making process, it is now possible to develop a set of performance indicators which can gauge the level of success or failure of individual departments which operate within the construct of enrollment management. The intent of this paper is to show how enrollment managers can clearly identify the strengths and weaknesses of individual offices, identify and implement reasonable outcome measures, and make attainable short and long term enrollment projections through the implementation of a performance indicator system.[1]

INTRODUCTION:

The definition of enrollment management has evolved over the past fifteen years and now encompasses most aspects of the student flow process. Enrollment management's principal charge is to understand students as they process through five critical transition stages: inquiry, applicant, enrolled, matriculation and alumni. Given this charge, it is imperative that enrollment managers develop and implement methodologically sound measures of performance in order to appraise the strengths and weaknesses of both offices and individuals who work within enrollment management.

Development of an enrollment management performance indicator system is predicated on two assumptions:

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[1] Some enrollment managers/planners may interpret this discussion as being too tied to the monetary aspect of the student flow process -- that experiential and academic issues are relegated to a second class role in this process. I have always maintained that effective use of institutional dollars will always translate into an positive academic institutional profile and encourage, rather than prohibit, student experiential growth. It is my position that quality, diversity, etc. are of premier significance, but even before we can deal with these issues, *institutional survival, balanced budgets, physical constraints and classroom facilities* must be dealt with.

- the enrollment manager *must* have jurisdiction over the principal offices which affect student behavior, and
- that the principal parties involved in the enrollment management process are intrinsically involved in the determination of the department's major *outcome* measures.

Enrollment management is an amorphous concept in search of a clear definition. Analogous to the chameleon, the ever-changing scope and nature of the enrollment manager's job description is reflective of the power and politics from which the position was born. In many institutions, enrollment managers have direct control over the admissions and financial aid offices. Still, at other institutions, enrollment managers have direct control over the admissions, financial aid, registrar, student services, and market/research offices. It is my premise that the larger the scope of the enrollment management office, the greater the possibility of implementing a sound performance indicator system. This possibility occurs since the enrollment manager has more *control* over the intervening factors which affect the student flow process.

The second assumption focuses on the inclusion of key staff members in the determination of important enrollment outcome measures. Effective outcome measures are based on clear and concise quantitative indicators which can inform an enrollment manager as to the efficiency and efficacy of each individual office. Albright (1986) is correct when he cites the difficulty of implementing traditional business concepts into the world of academia. He notes that the term *enrollment management* "... connotes an attempt at being business-like without the taint of used-car hucksterism ...".[2] It is relatively easy to talk about bringing business concepts into the educational arena -- it is much more difficult getting these concepts implemented, integrated and firmly established within this same arena. Without the development of an effective performance indicator system enrollment management, as a truly innovative concept, will diminish in stature and will be viewed by many as just another administrative *black-hole* -- another office spending money without a clear definition or purpose. It is my position that there is a positive correlation between staff members' involvement in the outcome measure development process and level of acceptance of these measures.

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[2] *Enrollment Management: Successor to Marketing or Its Synonym?*, by James Albright. College and University. Winter, 1986.

IMPORTANCE OF OUTCOME MEASURES:

Outcome measures. These two words cut to the heart of this discussion. Enrollment managers, in order to position their institution favorably in the 1990's, need to optimize their expenditure of resources both in terms of personnel and dollars. Enrollment managers must realize that their product, *education,* and the attitudes of their consumers, *students,* are impacted daily by representatives of the university (staff, students, professors, alumni, etc.). By devising key quantitative performance measures it is possible for enrollment managers to understand, evaluate, and hold accountable specific offices for their level of productivity.

However, outcome measures, by themselves, do not describe the whole story. A major function of the enrollment manager is to ensure that each office meets its specific objectives within pre-defined parameters. It is a waste of expenditures (both human and capital) to exceed objective measures originally agreed upon by the enrollment management staff. An enrollment manager must understand the internal dynamics of his/her institution, set clear and attainable objectives for each office, and evaluate the effectiveness of the outcome measures devised.

An illustration of the symbiotic relationship between offices within enrollment management can be described as follows. If the registrar states that the capacity for new freshmen enrollment is 1,000 it is then the job of the admissions director to bring to this institution not 900 students, not 1,100 students, but 1,000 students. Similarly, it is the job of the financial aid officer to work closely with the admissions office to ensure that financial aid expenditures are maximized in terms of attaining the 1,000 student threshold at the lowest cost possible[3].

This example illustrates the sense of interdependency among the varying offices which operate under the penumbra of enrollment management. Each office is somewhat autonomous in terms of its specific mission to the institution; however, it is critical that each office performs in a manner which is congruent with the overall enrollment management goals and objectives.

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[3] It is quite clear to me that financial aid, and for that matter, admissions, should not be evaluated strictly on the size and quality of the enrollment yield. Financial managers are interested in the return on their investment. A student who receives financial aid dollars and leaves after three semesters may not be as good as an investment as a student, who receives no aid and decides to stay only two semesters. It is the role of enrollment management to develop effective prediction models to determine the effects of financial aid on student persistence.

It is the intent of this paper to present several basic quantitative measures which are readily available to enrollment managers. I focus specifically on four offices which are often associated with the office of enrollment management. These offices are admissions, financial aid, registrar, and market/enrollment research.

The first step in the development of a performance indicator system is to define the *critical* outcome measure associated with each office. It is in my opinion that all outcome measures be directly linked to their effect on enrollment yield and/or retention. Failure to develop effective performance at this initial juncture will have serious ramifications on the evaluation staff performance within each particular office.

The overall plan of this paper is to discuss how enrollment managers should develop parsimonious outcome measures which take into account both individual and office level performance. A brief discussion of a performance indicator system, especially measures of performance at the office level of analysis, underscores the need for a model to be developed which can be implemented in an efficient manner by enrollment managers. I have listed below typical outcome measures which can be assigned to particular offices.

Major Outcome Measures:

- Admissions . . . . Total New FTE
- Financial Aid. . . . . . Dollars Expended Per Student
- Registrar. . . . . % class capacity utilized
- Marketing/Enrollment . . Enrollment Projection Model

As noted, the above outcome measures are modest but they do address one of the major quantifiable issues within these four areas. To be sure, each of these measures does not operate independently of each other; rather, it is the role of the enrollment manager to ensure that each office operates in a manner as to be is consistent with the overall objectives set forth by the enrollment management staff.

Enrollment managers need to developed outcome measures on two distinct levels. The first level, entitled the *macro* *level*, focuses on the effectiveness of the four general offices as they perform in relation to the overall enrollment management objectives.

The second level is appropriately entitled the *micro level*. Outcome measures at this level take into account the performance of specific sections within each particular office (e.g. the transfer student section within the admissions office). These outcome measures follow directly from the measures defined at the macro level but they are sensitive to the various tasks/missions within each particular office. Similar to the consensus management approach seen at the macro level, outcome measures at this level should reflect input from both the director and the person(s) in charge of each particular section.

The next section looks at two models which detail the inter-relationship between the various components at each level of analysis as well as the relationship between the macro and micro levels of analysis.

TWO LEVELS OF ANALYSIS: MACRO AND MICRO:

It is important to understand that all macro level objectives must be congruent with the overall institutional mission statement. Macro level objectives can be defined as:

- office level objectives which are jointly developed by the directors of the admissions, financial aid, registrar, market/enrollment research and the enrollment manager.
- Objectives which are quantitative measures of performance and should have a direct tie to the budgetary process of the institution.

In the final analysis, the enrollment manager is the individual in charge of implementing and evaluating the effectiveness of the outcome measures each office has determined.

Chart 1 depicts a 'four office' enrollment management concept: admissions, financial aid, registrar and market/enrollment research.[4] The common thread which intertwines these four offices is their direct relationship to

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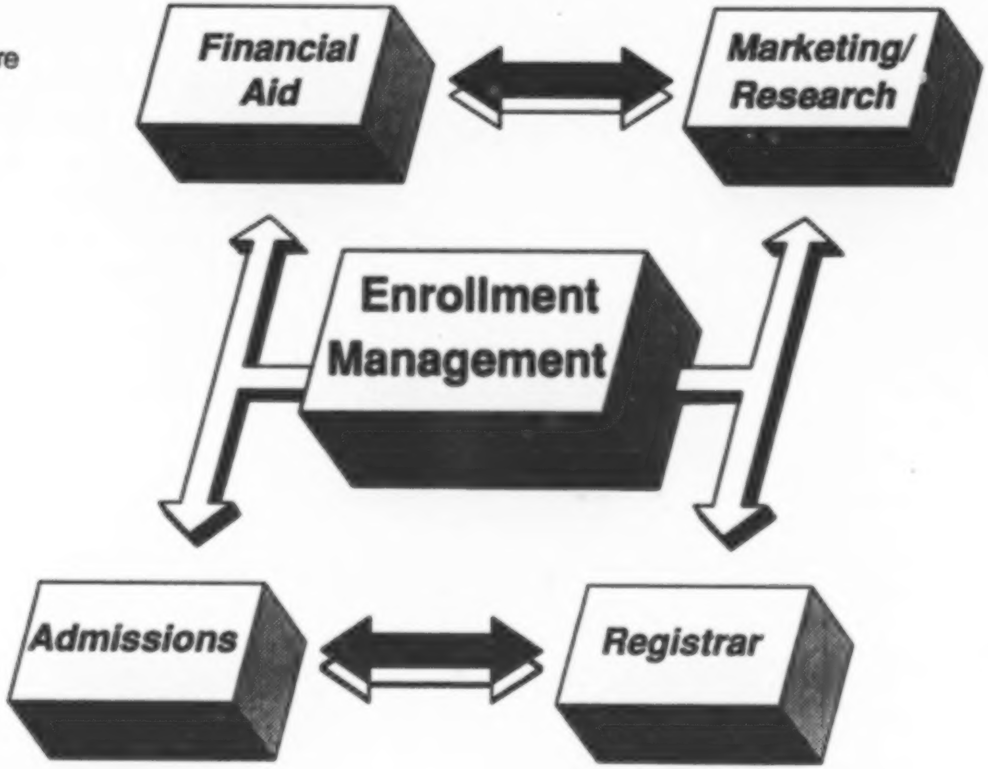
[4] For sake of brevity, in this paper I will only concentrate on these four offices. Other offices which would be critical to this model include, student services (retention) and alumni.

Chart 1
Enrollment Management Model

Macro Level



Objectives:

Dollar Expenditure
Per Student

Financial Aid

Marketing/ Research

Objectives:

Enrollment
Projections

Enrollment Management

1,000 New
Students

Admissions

Registrar

% Classroom
Capacity

the budget. For illustration purpose,

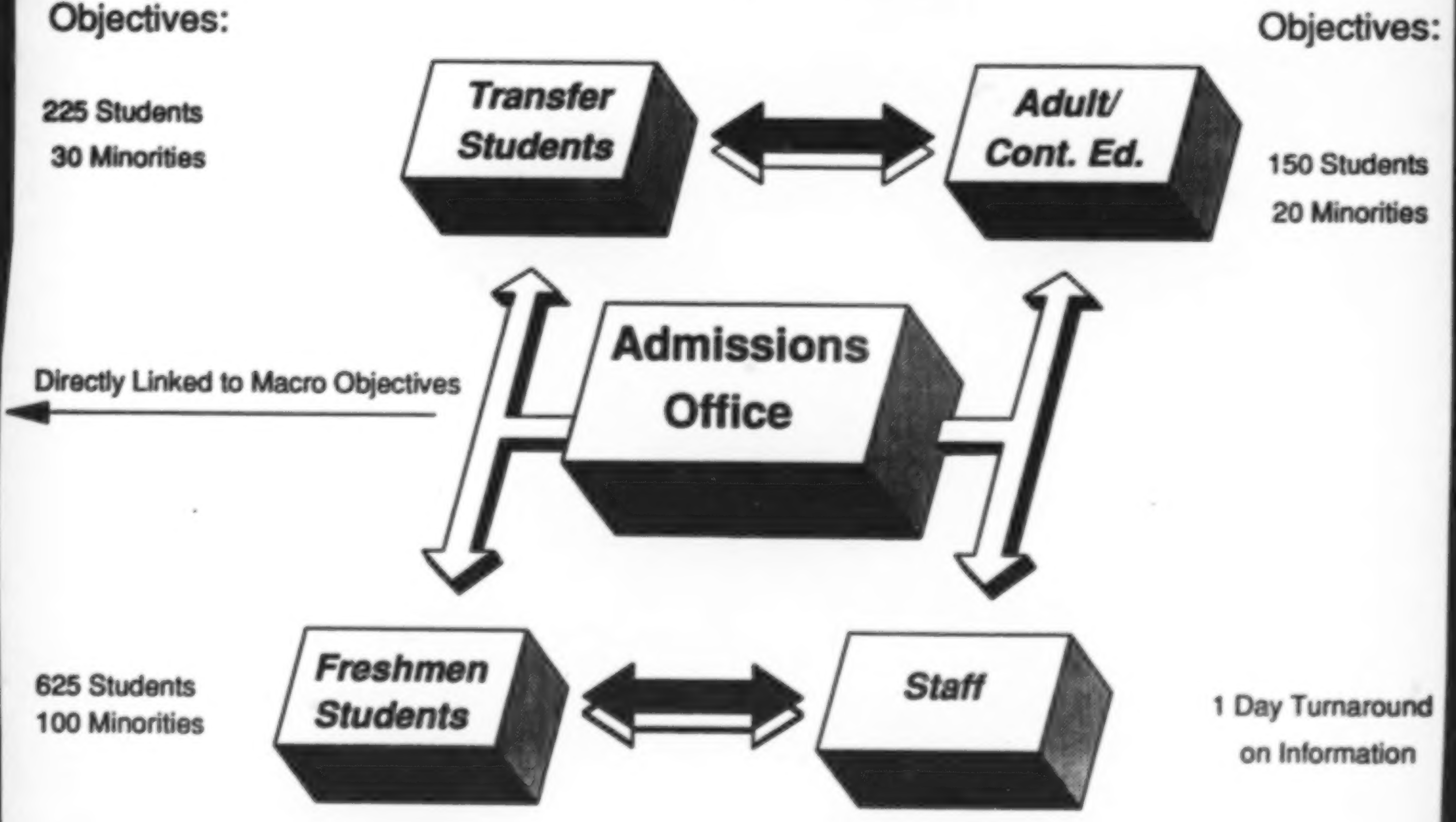
- the Admissions officer is responsible for 1,000 new students,
- The financial aid officer has to demonstrate how *effectively* s/he has spent the institution's financial aid dollars,
- the registrar is held accountable for the percentage of classroom space filled. How effectively a registrar schedules courses, maximizes ease of registration and so forth needs to be measured, and
- the marketing/research director must be held accountable for making well-informed enrollment projections. Poor enrollment forecasts will have ramifications on how well other offices will perform in relation to their stated objectives.

An enrollment manager needs to establish logical performance indicators at both the macro and micro level. At the micro level, performance indicators are directly linked to the higher level macro level objective(s). For example, it may be a primary function of the admissions office to recruit freshmen students, but it must still allocate resources to other areas such as transfer students, adult learner students, basic education students, etc.. Each of these specific tasks demand a specific outcome measure from which to evaluate the performance of each individual within each section.

Chart 2 shows how micro level objectives flow directly from the macro level. The locus of control, at the micro level, is the director of each office. The director has to determine the proper balance or mix of resources at the micro level in order to achieve the objectives set forth at the macro level. Therefore, a stated macro objective of the admissions office may be to enroll 1,000 new students. However, at the micro level, there may be many permutations in which this number can be reached. The scenario shown in Chart 2 outlines the micro level objectives. They are:

- the freshmen student coordinator is responsible for the recruitment of 625 students of which 100 are minorities.
- The transfer student coordinator is responsible for the recruitment of 225 students of which 30 should be

Chart 2
Enrollment Management Model
Micro Level


Objectives:
225 Students
30 Minorities
Transfer Students
Adult/ Cont. Ed.
Objectives:
150 Students
20 Minorities
Admissions Office
Directly Linked to Macro Objectives
625 Students
100 Minorities
Freshmen Students
Staff
1 Day Turnaround on Information

minorities.

- The adult/continuing education coordinator is responsible for the recruitment of 150 students of which 20 are minority students.

By establishing clear performance objectives at this level it is possible to develop short and long term strategies admissions strategies.

Performance Indicators: A Few Examples

The following charts illustrate how performance indicators can be used by enrollment managers to effectively monitor the student flow process.

Admissions:[5]

The admissions office has been the source of much study and inquiry. Quantitative measures have been developed which assist the admissions director in identifying students which match well with their institutional profile. When an institution is doing well, in terms of recruitment, it is very rare that the admissions office gets full credit. However, when an institution's enrollment numbers begin to decline, the admissions office comes under much scrutiny and criticism. With the development of a performance indicator system the admissions office can be evaluated, in an objective manner, on how well it did given specific enrollment objectives.

Chart 3 shows how enrollment yield can be studied by a variety of influential factors and market segments. This model looks at three treatment variables; each variable should be measured for its singular and combined effect on enrollment yield. By using demographic data, enrollment managers can use this model to evaluate admissions yield on a variety of market segments ranging in scope from gender to geographic regions. Similarly, evaluations can be made as to statistical

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[5] *Qualitative and Quantitative Variables in a Selective Admissions Process*, by Pamela Gramet and Lorraine Terracina. College and University. Summer, 1988.

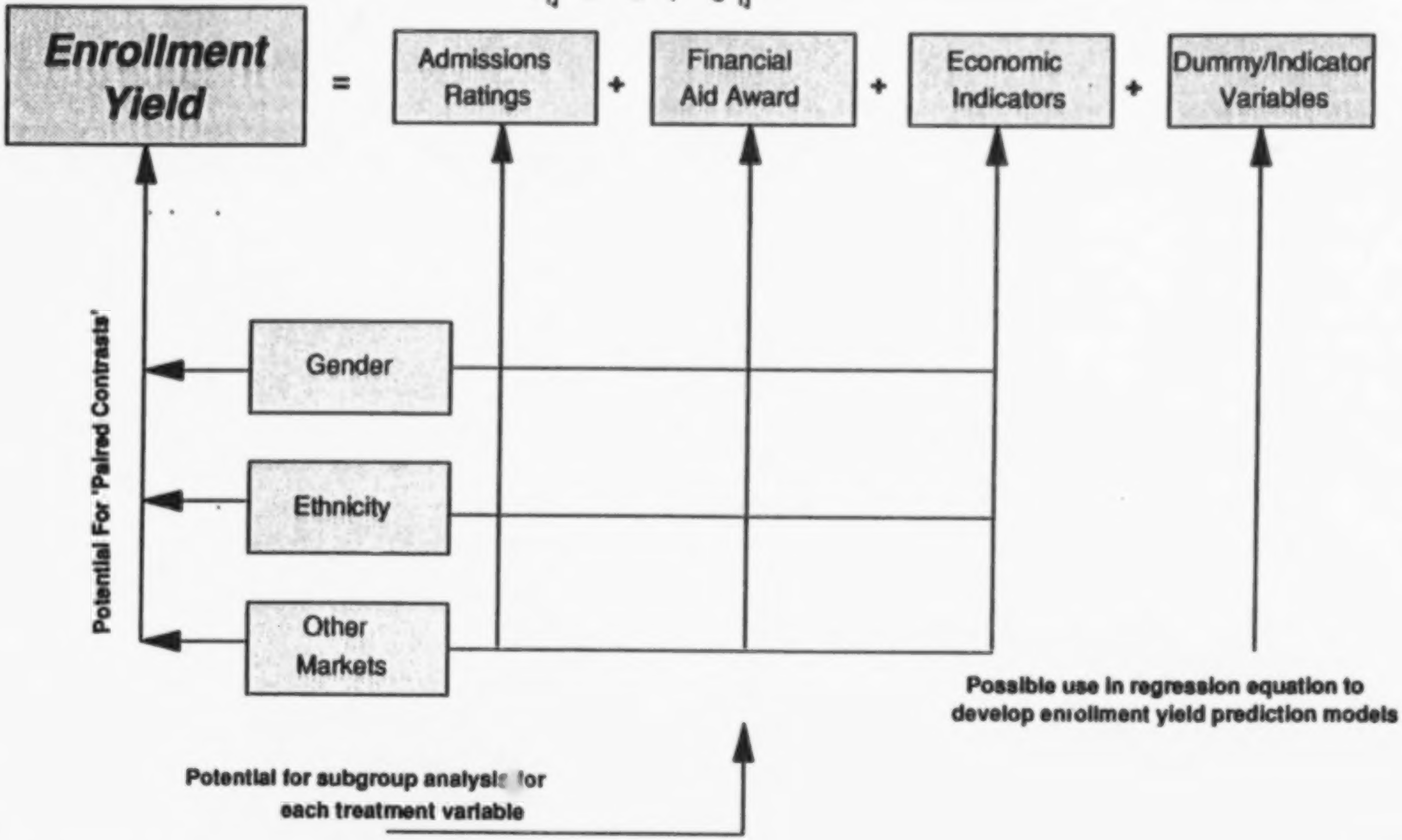
Admissions Market Research: An Alternative to Decline in the Eighties, by Anthony Lolli and James Scannell. College and University. Winter, 1983.

Coordinating Market and Evaluation Research on the Admissions Rating Process, by Robert Lay and John Maguire. Research in Higher Education. 1981 Agathon Press, Inc.

Chart 3

ANOVA: Comparing Multiple Group Means Scores On Three "Treatment" Variables

$$y_{ij} = u + e_{ij}$$



Enrollment Yield = Admissions Ratings + Financial Aid Award + Economic Indicators + Dummy/Indicator Variables

Gender

Ethnicity

Other Markets

Potential For "Paired Contrasts"

Possible use in regression equation to develop enrollment yield prediction models

Potential for subgroup analysis for each treatment variable

differences between these market segments and the individual treatment variables.

Chart 4 displays how enrollment yields can be measured by a variety of independent measures (in this instance academic ability as measured by a student's admissions rating) and a particular controlling variable (in this instance, admissions recruiters). The analysis shown in Chart 4 allows an enrollment manager and the director of admissions to effectively evaluate how well each recruiters performed in terms of both enrollment yield and academic quality.

Financial Aid:[*]

"Let's spend more on financial aid". When enrollments seems to be declining, or academic quality seems to be on the decline, one is certain to hear the above refrain. The only problem with this statement is that it is very rarely rooted in research. It is imperative that financial aid officers have a statistical understanding on how effective the aid is that they are granting to students. Effectiveness, in my mind, can be measured directly in terms of yield and retention. It is not enough to use simple financial aid/enrollment number ratios. One institution may meet, on average, seventy percent of a student's tuition cost. However, this expenditure may not be as effective as another institution which covers, on average, only forty percent of a student's tuition cost.

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[*] *The Impact of Financial Aid and Costs on the Student Recruitment Process*, by David J. Costello. Paper presented, Association for Institutional Research, April 30 - May 3, 1989.

The Effects of Single-Year Scholarships Versus Renewable Scholarships on Student Persistence, by Chris Woodward. College and University. Winter, 1988.

Conceptualizing Enrollment Behavior: The Effect of Student Financial Aid, by Michael E. Young and Pedro Reyes. The Journal of Student Financial Aid. Fall, 1987.

Buying Students - Where Will It End?, by Carl L. Hansen. College and University. Fall, 1986.

The Uses of Institutional Financial Aid As A Marketing Incentive in Higher Education, by Carol H. Anderson, Kathryn Ellickson, Juliette Nuetzel and Gordon W. White. The Journal of Student Financial Aid. Fall, 1985.

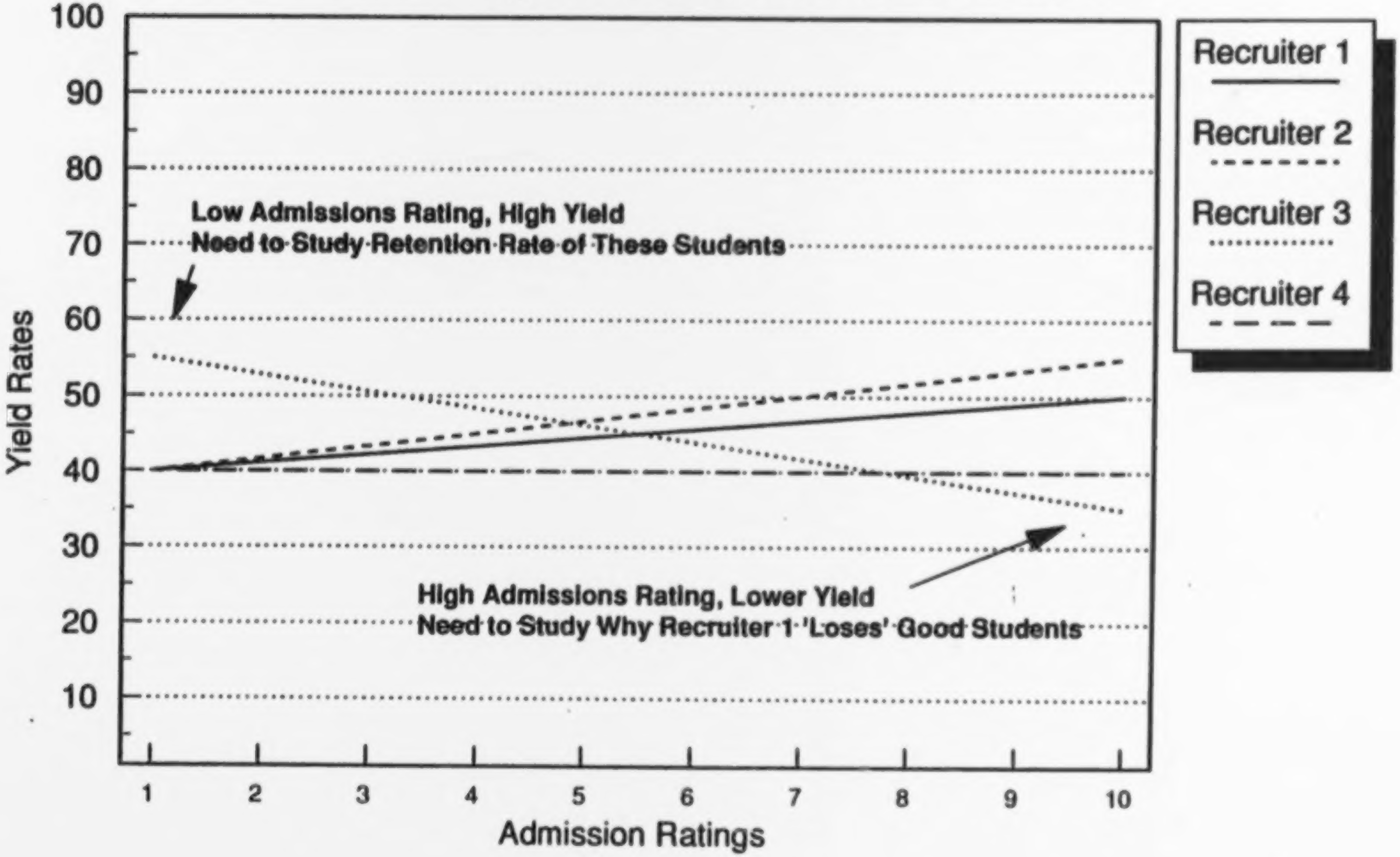
Student Financial Aid and Equal Opportunity in Higher Education, by A. Stephen Higgins. College and University. Summer, 1983.

The Uses of Institutional Financial Aid As A Marketing Incentive in Higher Education, by Carol H. Anderson, Kathryn Ellickson, Juliette Nuetzel and Gordon W. White. The Journal of Student Financial Aid. Fall, 1985.

Chart 4

Average Admission Ratings by Enrollment Yields

Controlling For Admissions Recruiter



Low Admissions Rating, High Yield
Need to Study Retention Rate of These Students

High Admissions Rating, Lower Yield
Need to Study Why Recruiter 1 'Loses' Good Students

Similarly, a financial aid officer must understand how different aid packages impact on specific outcome measures. Chart 5 shows a rather detailed path diagram which outlining a model which measures two types of aid (need based and merit based) as to their direct impact on enrollment yield. This model also takes into consideration some theoretical relationships between both demographics and academic ability and the type of financial aid awarded. The motto of every enrollment manager should be "don't tell me how much financial aid monies you have spent, tell me how *effectively* you have spent your financial aid monies".

Registrar Office:[7]

It is relatively easy to develop direct outcome measures for offices such and admissions and financial aid -- both of these offices have a direct link to the budget. At first glance, it may seem difficult to develop outcome measures for the registrar's office. However, I have long advocated that effective scheduling of classrooms and classes have a significant impact on indirect issues such as retention as well as an impact on more direct issues such as budgeting. Staff allocation and general operating costs are directly tied to how effectively a registrar schedules courses and classrooms.

For example, a course which operates most effectively with an average class size of twenty-five students should not be placed in a classroom which seats eighty students or fifteen students. Similarly, it is the responsibility of the registrar to understand the relative success or failure of a course based on the time slot it is scheduled for. For example, a course which may not be successful when scheduled at 10:00 am may be extremely successful when it is scheduled as an evening course. Through effective research, the enrollment manager should be able to understand the indirect relationship between course scheduling and course offerings on outcome measures such as student retention.

Chart 6 displays a typical registrar outcome measure. In a perfect academic world (this may indeed be an oxymoron!) each course should be placed in a classroom whose size correlates perfectly with the maximum number of students the individual department head has determined the class should have.

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[7] *Organization and Responsibilities of Offices of Admissions and Records/Registration*, by James E. Thomas. College and University. Summer, 1983.

Chart 5

The Effect of Financial Aid Award on Enrollment Yield

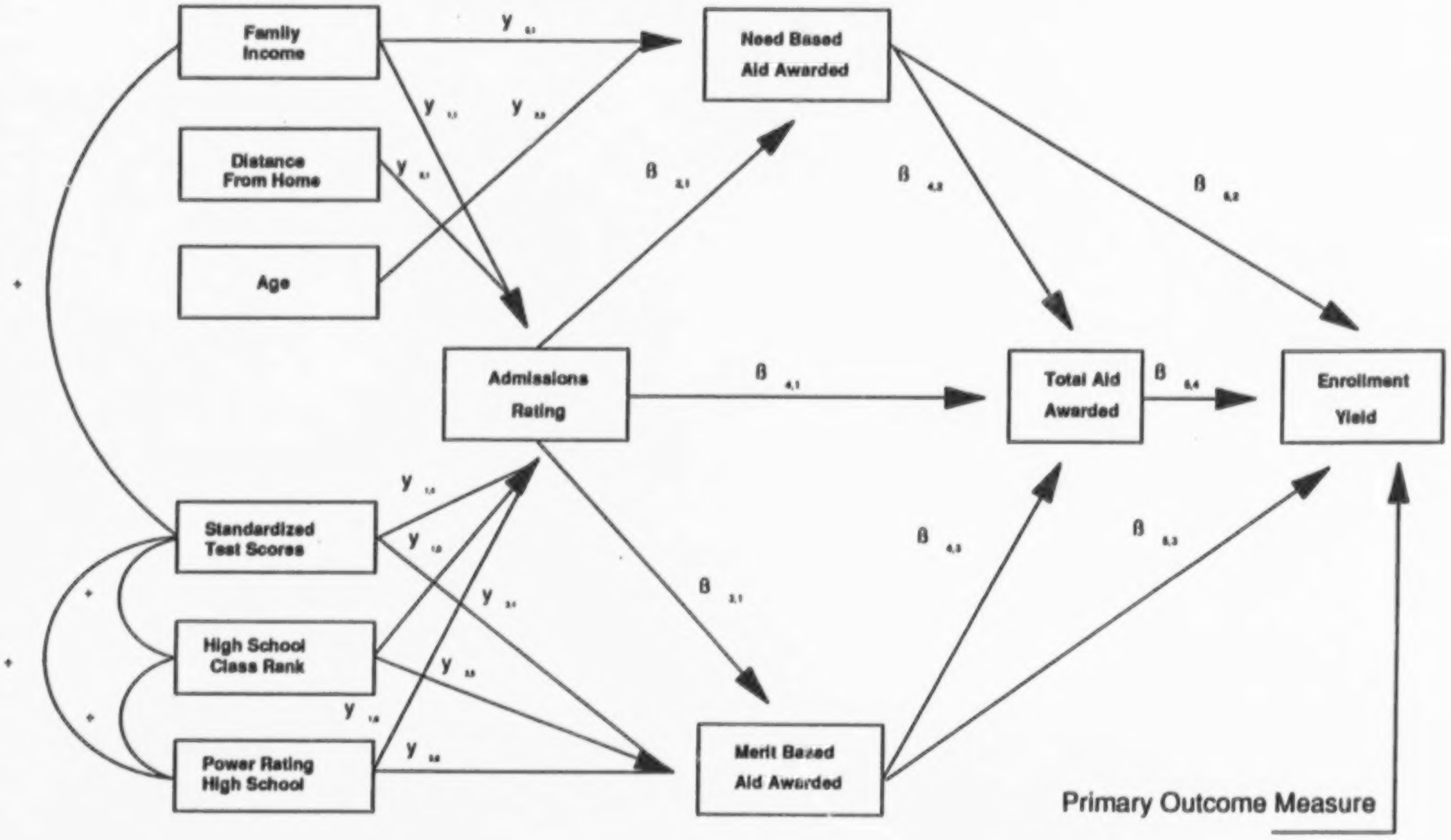
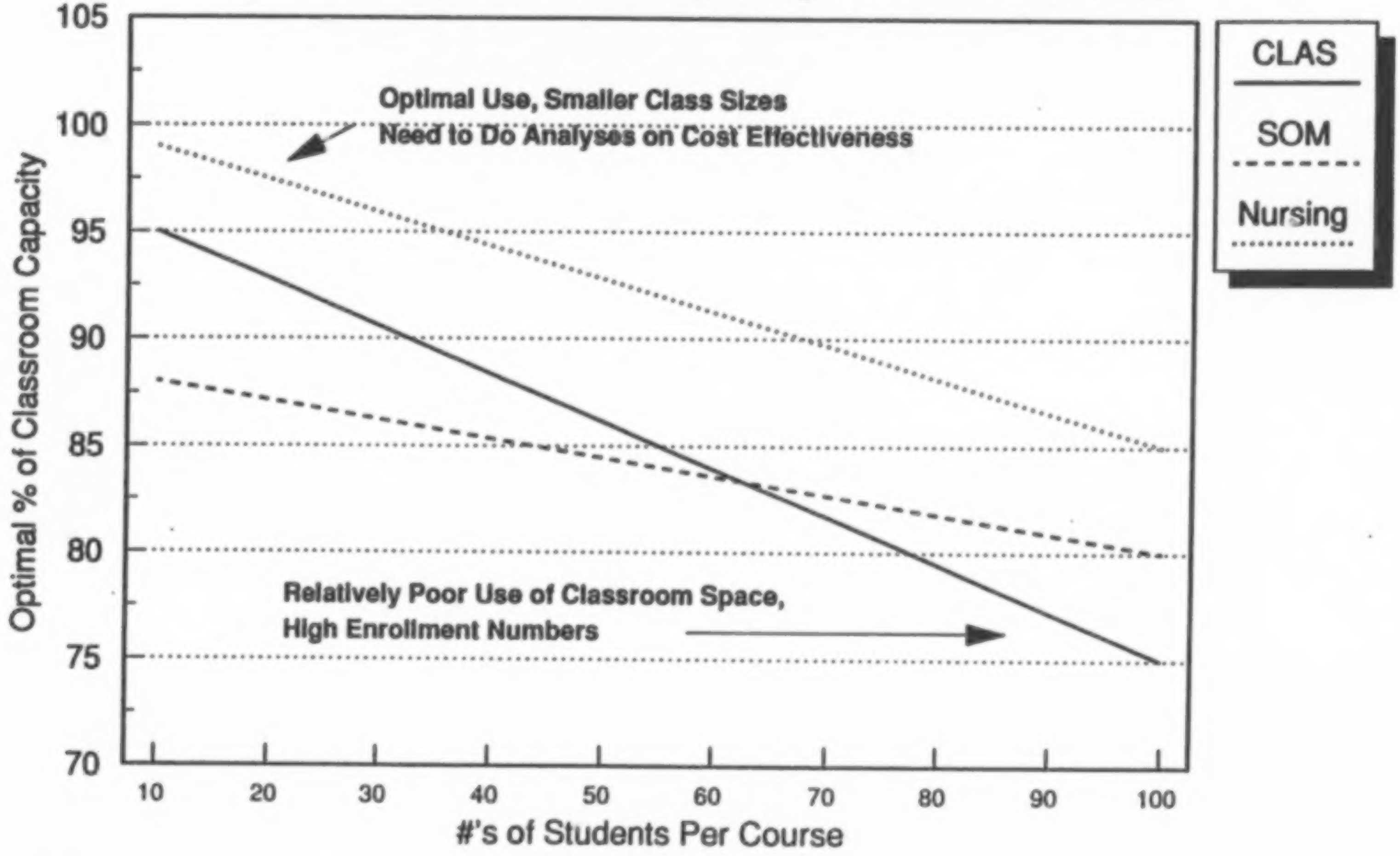

Family Income
Distance From Home
Age
Need Based Aid Awarded
Admissions Rating
Total Aid Awarded
Enrollment Yield
Standardized Test Scores
High School Class Rank
Power Rating High School
Merit Based Aid Awarded
γ 2,1
γ 1,1
γ 2,3
γ 1,2
β 2,1
β 4,2
β 5,2
β 4,1
β 5,4
γ 1,4
γ 1,5
γ 2,4
γ 2,5
γ 1,6
γ 2,6
β 3,1
β 4,3
β 5,3
+
+
+
+
Primary Outcome Measure

Chart 6

Optimal Percentage Use of Classroom Capacity
by # Students Currently Registered in Course



Optimal Use, Smaller Class Sizes
Need to Do Analyses on Cost Effectiveness

Relatively Poor Use of Classroom Space,
High Enrollment Numbers

Theoretically, from a budgeting point of view, any empty seat in a particular classroom can be viewed as lost dollar revenue. If a particular class is scheduled to handle 10 students and only 8 students enroll, the net effect is that the course is enrolled to only 80 percent of its capacity. Similarly, if a class is scheduled to handle 10 students and is placed in a room which can seat 100 students, the net effect is that 90 percent of the classroom space is being used ineffectively.

CONCLUSION:

Enrollment managers, as they moves into the 1990's, must be prepared to understand statistically how effective their operation is running. By relying strictly on *gut* instincts or proxy measures of performance (i.e. enrollment ratios) enrollment managers will flounder as they attempt to initiate sound strategic marketing plans.

The few measures that I have shown illustrate both the relative simplicity of performance indicators as well as the breadth of knowledge these few indicators reveal about both the state of the enrollment management system as well as the state of the institution itself.

Prometheus Unbound or Murphy's Law: A Rural Community College's Efforts to Apply Technology to the Enrollment Management Process

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Introduction

There is ample demographic documentation forecasting the impact declining birth rates of the 1960's would have upon college and university enrollment patterns during the late 1980's and early 1990's (Cope, 1985; Hearn and Heydinger, 1985; Leslie and Brinkman, 1987; Hearn and Longanecker, 1985; Taylor and Taylor, 1987). This birth rate decline has combined with limited fiscal resources to increase the competition for potential students (both traditional and non-traditional), particularly among and between various public sector enrollment driven institutions of higher education (Cope, 1985). In order to cope with this competition, many colleges and universities have placed a greater emphasis on environmental scanning, strategic planning, program development, assessment, academic integrity, etc. (Lozier and Chittipeddi, 1986). If properly implemented either individually, in combination, or as a group, these processes can have a significant impact upon an institution's effectiveness in general and on its enrollment in particular. However, for the regional community college with an open door admissions philosophy, effective implementation of any or all of these processes can cause a severe strain with one or several of the mandated constituency groups the college must serve (Cross, 1981; Cross and Fideler, 1989). Yet, to do nothing would force the institution into a state of abject inertia, where it is neither reactive nor proactive (Peterson, 1980). Therefore, careful planning of such a process is required in order to limit the potential constituency alienation while assisting the institution to achieve its mission. One vehicle which incorporates the aforementioned processes into a coherent design is a carefully planned and properly implemented enrollment management process. Such a process would not only scan the environment but provide valuable insight to student outcomes (Glover,1986). Thus, the purpose of this paper is two-fold: first, to describe the role of the institutional research office, at a small, rural, community college, in the development of an integrated enrollment management process; and second, to describe the technological successes and the "if it can go wrong, it will go wrong" syndrome which plagued the project implementation.

Background

The community college described in this paper is located in a geographically rural and remote, economically disadvantaged area, of upstate New York. Major employment opportunities in the area include tourism and tourism-related services, state/county and federal jobs, and a number of small industries.

The college is sponsored by two counties with a service area of approximately 3500 square miles. The college operating budget is developed from county contributions, tuition revenues, and state FTE charge backs. Thus, about 2/3 of the budget are derived from enrollment driven sources. In order to maintain the integrity of the budget, tuition charges have been increased to the state maximum levels. By restricting individual budget center allocations and maintaining large reserves during the academic year, the institution has built a satisfactory fund balance.

The college has a main campus, where the central administrative offices are located and three branch campuses. The branch campuses are located in excess of fifty miles from the main campus in opposite directions. There are approximately fifty full time faculty with over one hundred adjuncts hired each semester. Seventy-six per cent of the 1500 enrolled students have traditionally evolved from the two county sponsors. However, during the last four years there has been a steady decline in that enrollment, which has been in direct proportion to the area high school demographics. Yet, the overall FTE enrollment has remained steady due to an expanded inmate education program, which now includes four facilities. In preparation for a Middle States Accreditation, the college initiated a self-study process. One outcome of that process was the commitment to the design of an integrated, technologically oriented, enrollment management process. The foundation for the process was actually developed several years earlier, when the institution made a decision to steadily convert its management information system to a micro-oriented environment with up and down load capabilities between the administrative mini-computer.

Approach/Methods

The college's first step was to appoint a working committee of appropriate personnel, who were directly involved with imputing data or would benefit from the productive outcomes of the process (Table 1). Committee membership included the directors of admissions, student services, financial aid, the business office, institutional research and registrar. The committee met several times to discuss the process, research the concept and develop a working definition for enrollment management. The definition included several distinct components. They ranged from scanning the environment and examining the institutional image, to ascertaining the institutional cause and effect on student attraction, retention, attrition, program assessment, and alumni outcomes. In essence, the process would involve tracking cohorts of students from the time they expressed an interest in the college, up to and beyond graduation. It soon became apparent to the committee, that appropriate data would be an important and necessary component to properly initiate and evaluate the effectiveness of the process. Thus, the researcher provided each committee member with copies of the institutional fact books, attrition and alumni studies, and other pertinent data so they would know what was available and what could be generated. After reviewing the data, the committee began to develop the enrollment management model. The first stage involved developing an inquiry file to ascertain where students came from and why they were attracted to the institution. This stage included conducting a

TABLE 1

STAGES IN THE ENROLLMENT MANAGEMENT PROCESS

Committee Composition:
Individuals directly involved with imputing data or would benefit from the productive outcomes of the process. Membership included the directors of admissions, student services, financial aid, the business office, institutional research and registrar.

Definition of Enrollment Management:
Includes several distinct components. They range from scanning the environment and examining the institutional image, to ascertaining the institutional cause and effect on student attraction, retention, attrition, program assessment, and alumni outcomes.

STAGE ONE
Development of an Admissions Inquiry File
1. to ascertain where students originated from and why they were attracted to the institution.
2. to initiate a community assessment in order to scan the environment.

STAGE TWO
Tracking the Inquiry Cohort
1. to survey why applicant never completed the admissions process
2. to ascertain why enrolled students never attended

STAGE THREE
Tracking Enrolled Students for Attrition/Retention Purposes
1. to develop data profiles on the student population
2. to develop a series of attrition surveys

STAGE FOUR
Tracking Employment and Transfer Status of Alumni
1. to develop one and five year follow-up surveys

MEASURES OF EFFECTIVENESS
1. increase in admissions applications
2. increase in student persistent rates
3. increase in transfer and graduation rates
   (type of transfer institution and level of employment)

community assessment on various levels in order to "scan" the environment. The second stage centered on tracking the inquiry cohort up to and through the actual registration and payment process. This stage included surveying the potential students that never completed the admissions process or registered but never attended. The third stage required tracking cohorts of students to ascertain why they left the institution prior to graduation or persisted to graduation. This stage included a series of surveys and data profiles on the different categories. The final stage focused on employment and transfer status of alumni. This stage included a one and five year follow-up process. The effectiveness of the process would be measured by the increase of admission applications, a higher persistence rate, and by the number of transfer and graduation rates.

Having established the model, the committee began to examine the institution's capabilities to implement it. Although a number of components were in place, consensus was reached to initiate the process beginning with the inquiry stage. Due to limited staffing, the committee realized emphasis would have to be placed on the institution's administrative computing capabilities. Thus, a separate sub-committee on administrative computing was created. The function of the committee was to review the institution's administrative computer resources to ascertain what capabilities were in place, to establish priorities on usage, and to recommend what resources needed to be acquired to satisfy the data needs of the enrollment committee.

The computer committee then requested documentation on the design of the existing system. Figure 1 provides an abridged diagram of that flat file system design. Essentially, the admissions office had an application file. The application file fed the registrar's master file which then updated both the business and financial aid office respective files. Although a simple design, the system software was not on line and required constant up-dates. It was difficult to manipulate data to get required reports in a timely fashion. In addition, there was no available statistical package to properly manipulate files, so specific reports had to wait until the programmer could get to them. This would often take months and the quality of the reports was limited to the ability of the programmer. Due to limited resources and time constraints, the computer committee could not recommend the purchase of a new administrative main frame with appropriate software. However, suggestions on up-grading the Systems 34 were made and carried out. These included the addition of several ports, modems, and the over all up-grade of the system memory and usable disk space.

After the review was completed the computer committee made several recommendations: first, greater emphasis be placed on micro-computer hardware and software; second, the administrative mini-computer be utilized as a file server and archive with up and down load capabilities; and third, establishing open lines of communication to ensure standard system definitions and procedures.

Based upon the recommendations, the enrollment committee began to initiate a new system design, which incorporated the addition of micro-computers. Because it would be cost ineffective to totally utilize the System 34 just as an archive/file server, the committee developed a modified design. Figure 2 diagrams the micro enriched system design which utilized the System 34 partially as a file server and archive, and mainly as the administrative foundation for an expanded MIS.

Figure 1
Original System 34 Design

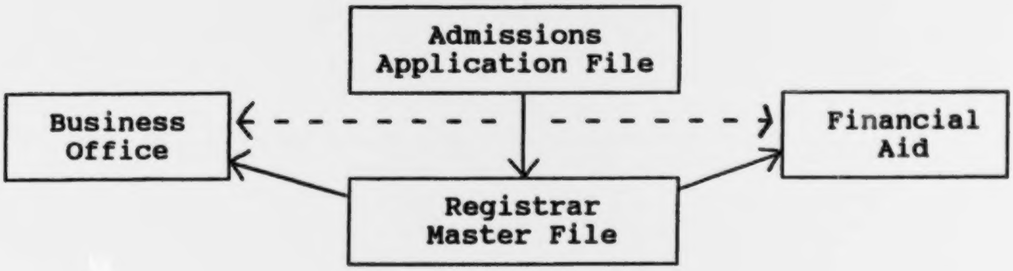
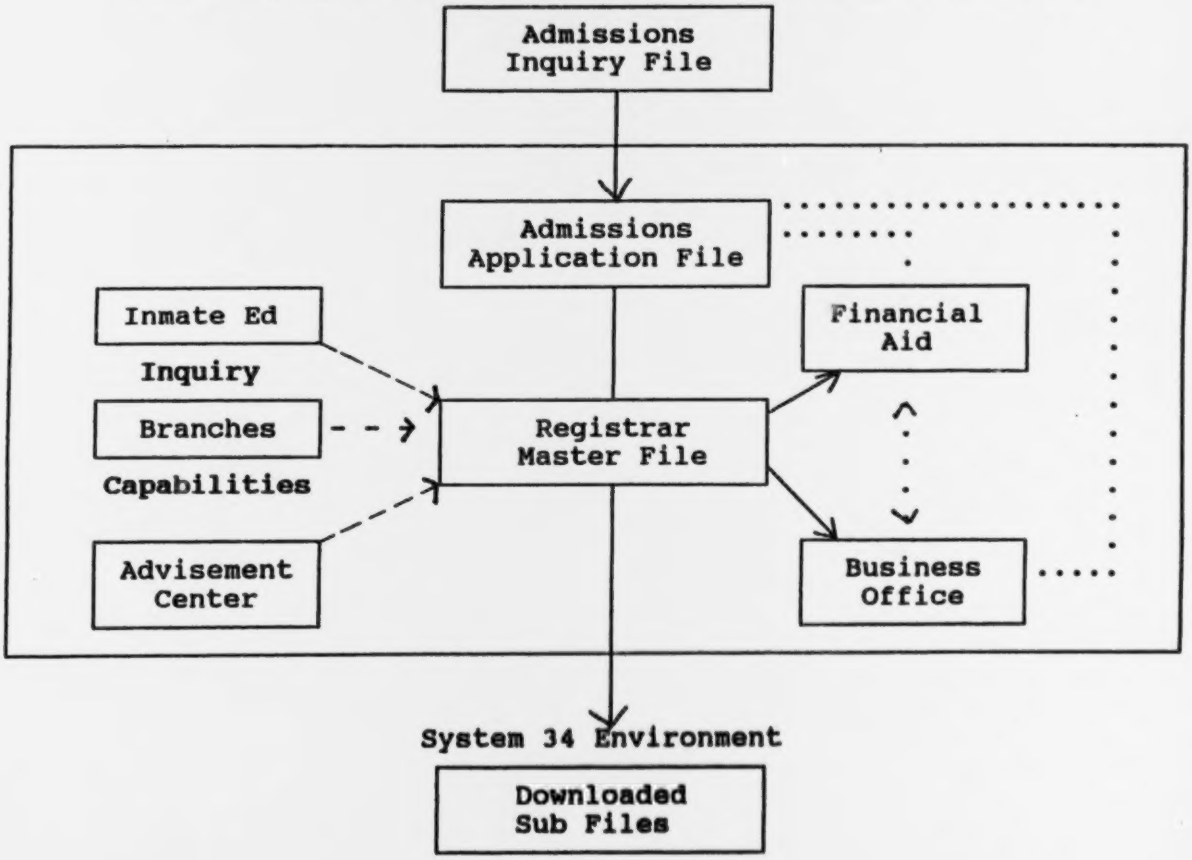

Admissions
Application File
Business
Office
Financial
Aid
Registrar
Master File

Figure 2
Simplified Micro Enriched Design
Utilizing System 34 Partially as Archive and File Server


Admissions
Inquiry File
Admissions
Application File
Inmate Ed
Inquiry
Branches
Capabilities
Advisement
Center
Registrar
Master File
Financial
Aid
Business
Office
System 34 Environment
Downloaded
Sub Files

The new design established a stand alone admissions inquiry file which would be developed on an IBM PS2 Model 50 using dBase III Plus software. Thus, multiple follow-up correspondence using Word Perfect 5.0 could be sent to potential students in order to enhance the admissions process. In addition, that file could be used by the institutional research office to initiate a series of studies on that population. After a student had applied and been accepted, a separate file would be generated and then up loaded to the System 34. The accepted file would serve as the basis for the student master file. Due to an extended open admissions policy, the accepted file would be updated on a weekly basis. Once migrated to the student master file, only the registrar's office would have the capability of changing or imputing select elements of a student's record. Concurrently, the financial aid office would have their files updated by the application file and for down load analysis on their IBM Model 30. This same procedure would apply for the Business Office files. Ultimately, both of those offices would have their appropriate files updated through the registrar's master files. The design was further expanded to enhance the inquiry capabilities of the inmate education program, both branch campuses and the main campus advisement center. The inmate education program had their IBM Model 30 hard wired to the System 34 to serve as both a dumb terminal and stand alone. The branches and advisement utilized modems to have their IBM Model 30s serve as both terminals and stand alones with access only to the registrar's student master file. Finally, selected elements from a variety of files could be down loaded to the institutional research office's IBM Model 55sx for appropriate analyses utilizing a SPSS PC package.

Outcomes: Prometheus or Murphy

Prometheus was a greek god that gave fire to man. Murphy's Law states, "if it can go wrong it will". Indeed, both of these apply to the efforts of this community college to apply technology (fire) to the development (Murphy's Law) of its enrollment management process.

As previously stated, the first step in the process was to appoint a working committee of involved personnel. The intent was to develop open and sincere lines of communication, which would lead to consensus and a commitment to have the project succeed. However, as with most committees of this nature, turf battles ensued. This led to distended lines of communication where consensus was reached but meant different things to each of the constituents. This resulted in a series of duplicate efforts on surveying specific cohorts of students with different questions leading to differing interpretations. While the impetus for a community assessment existed and was preliminarily planned, no resources were allocated and the process was abandoned.

Because the committee was limited to the available staffing, greater emphasis would be placed on micro-computers. However, each office was allowed to purchase whatever equipment they felt were appropriate. Thus, a number of these machines were purchased but not on a coordinated basis, which led to a series of communication problems, specifically involving networking. In addition, some areas purchased equipment which were soon outdated and required additional upgrades or new purchases. Concurrently, up and down load technical difficulties evolved with the administrative mini-computer. Unfortunately, the latter was only discovered after the admissions office had developed and begun to implement their inquiry file. Concurrently, additional configurations were built into the model to allow access to the student master file for areas such as the inmate education program, the advisement center and branch campuses. The former was hard wired to the administrative mini, while the latter two areas used modems for access. Due to technical difficulties, the latter two areas had to wait six months to finally work out the access difficulties. Because of that delay, those offices utilized fax machines to get copies of student records directly from the registrar's office. This proved to be so efficient that the on-line system which takes two to three minutes per page to bring up is now rarely used.

Once the admissions office inquiry file was in place and operating effectively, the model called for tracking cohorts of students to ascertain why they did not complete their applications or did but never actually attended. Because several offices were involved with that component, it became distended. Ultimately, the involved offices relied on a manual system developed several years earlier, which actually worked quite well.

Finally, the institutional research office was to coordinate, track and report on the various cohorts of students. While that office was able to acquire all the necessary hardware and software and work out down load procedures, the institution as a whole was unable to provide the necessary direction in the form of questions which needed answers. This led to extended volumes of data being generated which vested groups ignored because they did not like the outcomes.

Although it would appear that Murphy's Law was the rule and not the exception, the process did unleash technology upon the institution with a number of beneficial effects. First, all administrative offices were able to purchase micro-computers which substantially increase their efficiency and effectiveness. Indeed, to date most offices have at least two computers and in some cases as many as five. Second, the admissions application file did allow that office to keep in contact with a number of potential students which was previously impossible. That resulted in a larger first-time full-time entering class. Third, the administrative mini-computer is accessed by more offices but is relied on to a much lesser extent for report generation. Fourth, while not totally finalized, the institution is able to track cohorts of students. Once consensus is reached on what questions need to be answered, that process will supply substantial data for rationale decision making. Fifth, the institutional research office has now gained a statistical package for appropriate file manipulation. In addition, because it was important to know what data was available at the beginning of the process, the college community has gained a deeper insight to the functioning of that office and there has been a marked increase in its services. Finally, all of the involved parties have gained substantial knowledge on the operation, limitations and potential of technology and its applications. Concurrently, the enrollment management committee has learned that the facilitator of that process must be someone without a vested interest in any one particular area yet possess enough power to influence the individual members.

Due to the rural nature of the service area and the excellent fiscal position of the college, the design of the enrollment management process was developed around a technologically oriented, micro-enriched environment, where the administrative mini-computer partially served as both an archive and file server. To date, the model has not been completely implemented but several of the key components are operational, with the remainder scheduled to be in place by next year. While the process was thought to be carefully planned and organized, the unexpected led to a number of failures which hampered the anticipated outcomes. Yet, the project has already proven beneficial to the institution as a whole and to the "problem" of declining enrollment in particular. In addition, it has served as an excellent learning experience for all involved.

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THE UTILITY OF A FACULTY DATABASE IN DEVELOPING AND MONITORING AN INSTITUTIONAL SALARY PLAN

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INTRODUCTION

During the period 1980-83, salaries for the faculty and staff of a small, private, liberal arts college were frozen at 1979 levels. Since that period, salary increases have occurred, some years substantial. The increases, though, had not been sufficient to fully recover from the earlier years of salary freezes.

In August, 1988, the president of the institution appointed a campus-wide committee of administrators, faculty, and staff to advance a salary plan based on a study of institutional salaries. A three-year plan for raising faculty salaries and reducing inequities was adopted by the president and board of trustees in November of that same year. The first phase of implementation was completed in January, 1989.

The purpose of this paper is to discuss the utility of a computerized faculty database which facilitated the efforts of the committee. The database, combined with statistical and other in-house computer programs, accomplished several tasks. These tasks included measuring faculty salary equity, evaluating different methods for reducing inequities, determining salary percentage increases by rank necessary to achieve projected national averages in three years, and producing salary budget projections for the three-year period of implementation.

DEVELOPMENT OF A SALARY PLAN

Early on in committee deliberations, the issues of salary deficiencies and potential inequities became apparent. Of the two, the issue of equity in the faculty salary structure quickly surfaced as the primary concern to be resolved by the salary plan.

Analysis of salary equity was accomplished with a computerized faculty database and the Statistical Package for the Social Sciences (SPSS-X). To measure equity, the committee selected those factors which had been used at the college for salary determination in the past. The factors selected were rank, highest degree attained, and experience.

Research studies have cited these as well other factors, such as academic discipline and merit increases, as relevant to studies of faculty salary equity (Braskamp, Muffo, and Langston, 1978; Braskamp and Johnson, 1978; Cohn, 1973; Lassiter, 1983; Mohanty, Doddler, and Karman, 1986). The factors of academic discipline and merit were not considered, intentionally, in the salary study discussed here, although they may be relevant to other institutions.

Table 1
Coding Scheme for Rank and Highest Degree

Variable	Value	Definition
Rank	1	Instructor
	2	Assistant Professor
	3	Associate Professor
	4	Professor
Highest Degree	1	Bachelors
	2	Masters
	3	Masters + 30 hours
	4	Doctorate

The faculty database contained the following information for each of the 50 full-time faculty members: name, rank, highest degree, years of experience, and salary. The coding schemes used for rank and highest degree are shown in Table 1. Additional space was also reserved within the database for the purpose of storing projected salaries which will be discussed later.

Experience was defined to include three categories: (1) years of full-time teaching experience at the college, (2) years of full-time teaching experience in other post-secondary institutions, and (3) years of relevant experience. Up to 15 years of relevant experience could be included with three years of relevant experience equated to 1 year of counted experience. Relevant experience was equated based on the past method of calculating salaries at the institution. Experience was coded as the sum of the three categories.

Table 2 presents the correlation coefficients for faculty salaries with rank, experience, and highest degree. The correlation of salary with rank (.6907) implied a stronger relationship than salary with highest degree (.5805). Experience was highly correlated with academic rank (.7843), although not highly correlated with the faculty salary (.4926).

Table 2
Correlation Coefficients of Initial 1988-89 Faculty Salaries with Rank, Experience, and Highest Degree

	Salary	Rank	Experience
Rank	.6907		
Experience	.4926	.7843	
Highest Degree	.5805	.5341	.2878

To determine the extent to which these three factors might collectively explain the variation in faculty salaries, a multiple linear regression analysis was conducted. Several studies such as those cited above have employed multiple regression for this purpose.

The multiple regression analysis performed with the faculty database indicated that 50.9 percent of the variation in faculty salaries could be explained by faculty rank, experience, and highest degree. Of the variation explained, 47 percent was attributed to faculty rank alone. Experience and highest degree were found to be statistically insignificant (at a level of .01) in predicting salary. The concern over inequity seemed warranted inasmuch as some other set of factors accounted for nearly as much of the variation in salaries as the three factors included in the definition of equity.

Salary deficiencies by rank were also measured in developing the salary plan. For comparison, the committee chose to use national salary averages because such statistics were readily available and provided an expedient measure. The American Association of University and College Professors (AAUP) annual survey of faculty salaries was selected for purposes of comparison. National salary averages by faculty rank were also selected as the goal for future faculty salary averages at the college. Within the AAUP survey, category IIB salary averages were used for comparison as the category of best fit.

At the time of the study, national salary averages for 1988-89 were not known. The 1987-88 averages and percentage increases over 1986-87, therefore, were employed to project the 1988-89 national averages (AAUP, 1988). The percentages were applied to the respective 1987-88 national averages to produce the projected 1988-89 averages.

Column 1 of Table 3 indicates the percentage difference of the existing average salary by rank at the institution as compared to the projected national averages by rank for the 1988-89 academic year. The average salary for full professors, for example, was 29.5 percent below the projected national average for full professors.

THE SALARY PLAN

The salary plan proposed by the committee included two phases of implementation. Phase 1 sought a mid-year adjustment to faculty salaries, primarily to restore salary equity. Phase 2 of the plan sought to raise the average faculty salary, by rank, to the projected national averages in three years. The faculty database aided the committee's efforts in projecting the mid-year adjustments and percentage increases necessary to achieve projected national averages in three years.

A factoring formula used in the past at the college was modified to adjust faculty salaries based on rank, highest degree, and experience. A computer program, accessing the faculty database, was utilized for determining the weights to be assigned to the three factors for salary determination. Weights for rank, highest degree, and experience were chosen which maximized equity within the salary structure. A base salary for the factoring formula was also calculated which would limit the total salary increases to the budgeted amount approved for the mid-year adjustment.

A multiple regression analysis was performed with the adjusted salaries as the dependent variable to determine the extent to which equity had been restored in the faculty salary structure. Rank, highest degree, and experience were found to explain 87 percent of the variation in the adjusted salaries, an increase of 37 percent over the existing salary structure. The three independent variables were each found to be statistically significant at a .01 level.

Correlation coefficients for the three factors with salary also increased. These results are not surprising since salaries were adjusted based on these factors.

The phase 1 mid-year adjustment, while primarily addressing salary equity, also raised the average salary for each faculty rank. Column 2 of Table 3 presents the percentage differences between institutional and projected national average salaries by rank after the mid-year adjustment.

Table 3
Percentage Differences Between Average Salaries and the Projected/Actual AAUP Category IIB Salaries by Faculty Rank
1988-89

Rank	(1) Before Phase 1	(2) After Phase 1	(3) Actual
Professor	- 29.5%	- 8.0%	- 9.2%
Associate	- 15.1	- 0.1	- 0.6
Assistant	- 1.0	+ 6.5	+ 7.1
Instructor	- 10.6	- 3.8	- 2.2

Phase 2 of the salary plan, presently being implemented, attempts to achieve the national averages for faculty salaries by rank for category IIB institutions. The 1987-88 national salary increases by rank were used for the purpose of projecting national salary averages for each of the three years (AAUP, 1988). The faculty database was utilitized to determine the percentage increases required at the institution over the three-year period. The percentage increases were applied beginning with the 1989-90 academic year. A computer program, using the faculty database, provided a salary budget that could be anticipated for each year of the three-year period.

MONITORING THE SALARY PLAN

With the first of the three years of phase 2 implemented, the faculty database was accessed to evaluate the progress of the plan. The faculty database was updated to reflect the 1989-90 faculty of the institution. The 1988-89 national salary averages by faculty rank were also available for evaluating the actual success of the mid-year adjustment completed in phase 1 of the salary plan.

Analysis of equity for the 1989-90 faculty salary structure revealed that equity is stronger now than after the mid-year adjustment. The multiple regression analysis indicated that the factors of rank, degree, and experience, all significant at the .01 level, explain 92 percent of the variation in current faculty salaries. This represents a 5 percent increase in the variation explained after the January, 1989 adjustments. The increased variation explained may be indicative of the use of the factoring formula in determining initial salaries for newly hired faculty members.

Recovery of salary deficiencies compared to national averages has also been successful. Column 3 of Table 3 presents the actual percentage differences between the institutional average salaries after the January, 1989 adjustment and the 1988-89 national averages for category IIB institutions (AAUP, 1989).

The 1988-89 expected deficiency for the ranks of professor and associate professor were slightly missed. The average professor salary, expected to be 8 percent below the national average, was actually 9.2 percent below. The associate professor average salary was 0.6 percent below the national average, although projected to be 0.1 percent below.

The assistant professor and instructor average salaries, on the other hand, were better than expected in comparison to the national averages. The average salary for assistant professors for 1988-89 was 7.1 percent above the national average, though projected to be only 6.5 percent above. The average instructor rank salary, while still below the national average, was below by a smaller percentage than expected.

CONCLUSION

Significant progress has been made in addressing the issues of institutional salary equity and deficiencies. The creation of a computerized faculty database and the use of statistical and other in-house computer programs facilitated the efforts of the campus-wide salary review committee in effectively developing a salary plan for this small, liberal arts college. The faculty database was integral to statistical analyses of salary equity, developing a factoring formula, determining salary increases by rank as well as a three-year salary budget. The database, by design, was easily accessible to both the statistical software and other programs.

The faculty database as well as the other uses of technology added substance and accuracy to the salary plan for this institution. The use of technology in the study of institutional salaries provided the committee with evidence, rather than mere suspicion, of salary deficiencies and inequities. What is more, the use of technology enabled the committee to easily explore alternatives in order to submit a comprehensive salary plan on a timely basis.

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Factors Influencing Graduate Student Retention

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INTRODUCTION

With the exception of the period following World War II, the drop-out rate among college students has remained at approximately 45% (Tinto, 1982). Information regarding graduate student drop-out rate is not maintained by the National Center for Educational Statistics, the Council of Graduate Schools, The Chronicle of Higher Education, or the National Science Foundation, although representatives of these organizations feel the rate is substantial.

Bean (1982) states that factors influencing students to drop out and the interrelationships among factors are based on background variables, organizational variables, environmental variables, and attitudinal and outcome variables. This is a model that can assist institutional researchers in identifying factors associated with graduate student retention. But the reasons students interrupt, postpone, or drop out of educational programs are multidimensional: financial difficulties; motivational problems; personal consideration; full-time jobs; the expressed need for new, practical, nonacademic experiences; and lack of initial plans to obtain a degree (Ramist, 1981). In addition, enrollment in graduate level educational programs places students at high risk for developing physical and psychological health problems (Mallinckrodt, Leong, & Kralj, 1989), which ultimately may contribute to "stopping out" or "dropping out."

Naylor and Stanford (1982) believe that retention is a viable tactic for reducing the effect of the anticipated decline in the college pool, and retention data can be a valuable aid in an institution's planning efforts. Therefore, the goal of this project was to identify factors related to graduate students' decisions to postpone, interrupt, or withdraw from the programs in which they originally enrolled. The following eight items were the basis of the assessment: (1) original reasons for attendance; (2) original sources of information about the program; (3) interaction with faculty members or staff members prior to enrollment; (4) plans to resume; (5) factors which led to interrupting, postponing, or withdrawing; (6) original educational goals; (7) perceptions of personal experiences at the graduate center; and (8) total number of credits earned.

METHODS

During spring semester, Planning Studies, a Penn State institutional research office, assisted an Office of Graduate Programs administrator with a telephone survey of graduate students previously enrolled in a variety of certificate and degree programs. The survey was conducted to identify factors related to graduate students' decisions to postpone, interrupt, or permanently withdraw from their degree programs.

A population of 102 graduate students not enrolled since Summer Session, 1986 was identified. These students were candidates for degrees or certificates in engineering science, industrial engineering, principal certification, public administration, special education, or training design and development.

Advance letters inviting recipients to participate and describing the project purpose, telephone interview dates, and estimated length of interview were mailed March 31, 1989. Nine advance letters were returned marked "insufficient information" or "no longer at this address." Nineteen additional former students were unable to be reached due to inaccurate telephone numbers or disconnected phones, reducing the sample to 74.

Telephone interviews were conducted April 10 to May 5, 1989, primarily during evening hours. Of the 74 former graduate students called, 86% (n = 64) agreed to participate, two refused, and eight could not be reached.

RESULTS

Background Characteristics

The overwhelming majority (95%) of respondents were white. Over three fourths (78%) of the respondents were male, less than one fourth (22%) were female. Three fourths (75%) of those who responded were married, and approximately one fourth (23%) were single. Over three fourths (78%) of the respondents were between the ages of 26 and 35. Nearly all (95%) respondents worked full time. Seventy-seven percent (n = 49) of the respondents reported a suburban home location.

The most frequent fields of employment were computer programming (26%), engineering (18%), and computer science (11%). The highest level of education of the majority (89%) of respondents was graduate credits without a master's degree. Nearly three fourths (70%) of the respondents were enrolled in Engineering Science, while 9% were enrolled in Industrial Engineering.

Respondents also were asked to verify the academic year of their last enrollment. The majority (69%) of the respondents last enrolled during the 1986-87 academic year: of these one fourth (25%) last enrolled during fall semester, 1986 and 42% last enrolled during spring semester, 1987.

Nearly half (41%) of the respondents had completed between 26 and 30 of the required credits for their degree program. When asked how long they took to complete their undergraduate degree, over half (59%) of the respondents said four years.

Reasons for Attendance

The original educational goal of almost all (92%) respondents was to earn a master's degree at Penn State, while 3% each enrolled to fulfill certification requirements (n = 2) or for professional development (n = 2).

As shown in Table 1, the reasons respondents enrolled varied. Nearly all respondents, however, indicated the possibility of attending part-time (n = 62) and the availability of the degree program (n = 61) as reasons. The majority of respondents also indicated that Penn State's academic reputation (n = 54), class scheduling (n = 53), and tuition assistance availability (n = 41) were related to their decisions to attend. Half (n = 32) of the respondents said their employers encouraged them to attend.

Table 1
REASONS STUDENTS ATTENDED

REASON	Yes %	Yes (n)	No %	No (n)	Total %	Total (n)
Possibility of attending part time	97	(62)	3	(2)	100	(64)
Availability of degree program	95	(61)	5	(3)	100	(64)
Academic reputation of Penn State	84	(54)	16	(10)	100	(64)
Scheduling of classes	83	(53)	17	(11)	100	(64)
Availability of tuition assistance	64	(41)	36	(23)	100	(64)
Reputation of graduate center	56	(36)	44	(28)	100	(64)
Location of graduate center	55	(35)	45	(29)	100	(64)
Employer encouragement	50	(32)	50	(32)	100	(64)
Lost	41	(26)	59	(38)	100	(64)
Reputation of degree program	36	(23)	64	(41)	100	(64)
Class size	10	(10)	84	(54)	100	(64)
Campus size	11	(7)	89	(57)	100	(64)
Recruited by a Penn State recruiter	3	(2)	97	(62)	100	(64)
Other*	41	(26)	59	(38)	100	(64)

* Other reasons cited included: Location of courses, location of campus, curriculum, PSU undergraduate, convenience, and value of degree.

In addition, respondents were asked to identify the most important reason they attended. As shown in Table 2, location was most important for approximately one third (34%) of the respondents, and the reputation of Penn State was the most important reason for 15% of the respondents.

Table 2
MOST IMPORTANT REASON STUDENTS ATTENDED

REASON	Percent	Number
Location	34	21
Reputation of Penn State	15	9
Available degree program	13	8
Other*	13	8
Scheduling of classes	8	5
Tuition assistance	6	4
Possibility of attending part-time	5	3
Employer encouragement	5	3
Campus size	2	1
TOTAL**	101	62

* Other category included each of the following: PSU undergraduate, curriculum, and value of degree.

** Percentages total more than 100 due to rounding.

Enrollment Characteristics

Respondents were asked a series of questions regarding their decisions to enroll. These questions concerned their sources of information, interaction with faculty and staff prior to enrolling, plans to continue the program, and factors that led to interruption or termination of their degree program.

As shown in Table 3, approximately half of those responding said that a friend/colleague (_n_ = 36) or an employer (_n_ = 29) provided information about the graduate degree programs. Approximately one fourth (_n_ = 15) of the respondents said they received a mailing at work, and a similar number (_n_ = 14) read a newspaper advertisement.

Table 3
INFORMATION SOURCES

	Yes		No		Total	
SOURCE	%	(n)	%	(n)	%	(n)
Friend/Colleague	6	(36)	44	(28)	100	(64)
Employer	45	(29)	55	(35)	100	(64)
Mailing to office	23	(15)	77	(49)	100	(64)
Newspaper advertisement	22	(14)	78	(50)	100	(64)
An announcement to my home	14	(9)	86	(55)	100	(64)
College/graduate school guidebook	12	(8)	88	(56)	100	(64)
Other*	11	(7)	89	(57)	100	(64)
Attended an open house	8	(5)	92	(59)	100	(64)
Penn State representative	5	(3)	95	(61)	100	(64)
Telephone book	5	(3)	95	(61)	100	(64)
Career counselor	3	(2)	97	(62)	100	(64)

* Others cited included: Penn State alumni, live and work in the area, brochure in library, radio advertisement, and president of the company.

Nearly three fourths (73%) of the respondents said they did not have personal interaction with faculty and staff members prior to enrolling (Table 4). Of the 17 respondents who did interact with faculty and staff members, nearly half (_n_ = 8) said they spoke with a faculty advisor.

Table 4
PERSONAL INTERACTION WITH FACULTY AND STAFF MEMBERS PRIOR TO ENROLLMENT

INTERACTION	Percent	Number
No	73	47
Yes	27	17
TOTAL	100	64
Method of Interaction*		
Talked with a faculty advisor	47	8
Telephone conversation	24	4

Table 4 (continued)
PERSONAL INTERACTION WITH FACULTY AND STAFF MEMBERS PRIOR TO ENROLLMENT

INTERACTION	Percent	Number
Other**	24	4
Attended a presentation at my job	18	3
Attended an open house	18	3
Talked with a staff member	6	1
TOTAL***		

* Includes only those who interacted (n = 17).
** Other category includes worked with faculty, attended Ogontz, and visited a professor.
*** Since respondents were asked to identify as many interactions as appropriate, percentages total more than 100.

Plans to Continue

As shown in Table 5, respondents were asked about their plans to continue the program in which they had enrolled. Over three fourths (77%) of the respondents planned to continue, and two said they were unsure. Also shown in Table 5 are the factors leading to interrupting the degree program.

The 51 respondents who planned to continue or who were unsure about continuing were asked to identify the factors that had contributed to their decision to interrupt the degree program. Over half (n = 29) of this group said that working on the required paper contributed to their decision to interrupt the degree program, while thirteen cited a heavy work schedule and ten noted trouble with beginning the thesis requirement.

Table 5
PLANS TO CONTINUE PROGRAM

RESPONSE	Percent	Number
Educational Plans		
Will not continue	20	13
Expect to continue	77	49
Unsure	3	2
TOTAL	100	64
Factors That Led to Interruption of Degree*		
Working on required paper	57	29
Heavy work schedule	25	13
Trouble with paper	20	10
Family/time constraints	18	9
Newborn	18	9
Building a house	12	6
Moved	12	6

Table 5 (continued)
PLANS TO CONTINUE PROGRAM

RESPONSE	Percent	Number
Schedule conflicts	10	5
Lost impetus	6	3
Financial considerations	6	3
Transferred to University Park Campus	4	2
Evaluating goals	4	2
Received wrong information from my advisor	4	2
Divorce	4	2
Changed jobs	2	1
Study for PE exam	2	1
Injured at work	2	1
Started at a new university	2	1
Reconcile deferred grade	2	1
Not enough was offered	2	1
Stale study habits	2	1

* Includes only those who expect to continue or were uncertain about continuing their education at Penn State Great Valley (n = 51).
NOTE: Since respondents were asked to indicate as many factors as applied, percentages total more than 100.

Factors Leading to Terminating the Degree Program

The 13 respondents who indicated they would not continue the degree program in which they had enrolled also were asked to identify factors which led to their termination of their program. As shown in Table 6, work and time demands (n = 3), wanting a specialized degree (n = 3), and realizing the degree was not needed (n = 3) were the most frequently mentioned reasons. Two respondents felt the course outline was vague, two decided to change their major, and two were generally dissatisfied with instruction.

Table 6
FACTORS WHICH LED TO TERMINATION OF PROGRAM AT PENN STATE GREAT VALLEY*
(n=13)

FACTOR	Percent**	Number
Work/time demands	23	3
Wanted a specialized degree	23	3
No need for a degree	23	3
Course outline vague	15	2
Changed major	15	2
Instructor was an "idiot"	15	2
Waste of money/poor classes	15	2
Wanted full time master's degree	8	1
Program too intense	8	1
Waiting for credit transfers	8	1

Table 6 (continued)
FACTORS WHICH LED TO TERMINATION OF PROGRAM AT PENN STATE GREAT VALLEY*
(n=13)

FACTOR	Percent**	Number
Changed jobs	8	1
Tuition reimbursement no longer available	8	1
Uninterested in direction of program	8	1
Uncooperative advisor	8	1
Students unprepared	8	1
Students' backgrounds too varied	8	1

* Includes only those who expected not to continue the degree program in which they originally enrolled.

** Since respondents were asked to indicate as many factors as appropriate, percentages total more than 100.

Factors Associated with Plans to Continue

Another way to view these results is by considering whether or not differences in plans to continue are related to demographic characteristics such as marital status, gender, or age. Examination of data in this manner required viewing the data in mutually exclusive categories: under or over age 30, male or female, and married or single.

Marital Status

As shown in Table 7, marital status appeared to affect respondents' plans to continue. Of those who were married, over three fourths (85%) said they planned to continue, while slightly over half (60%) of single respondents planned to continue, a finding that approached significance χ^2 $(1, n = 61) = 4.14, p < .051$.

Table 7
PLANS TO CONTINUE BY MARITAL STATUS

PLANS	STATUS					
	Married		Single		Total	
	%	(n)	%	(n)	%	(n)
Will not continue	15	(7)	40	(6)	21	(13)
Expect to continue	85	(39)	60	(9)	79	(48)
TOTAL	100	(46)	100	(15)	100	(61)

χ^2 $(1, n = 61) = 4.14, p < .051$

Age

As shown in Table 8, age did not seem to influence plans to continue. Approximately three fourths of those under age 30 said they would continue

(78%), and 81% of those age 30 or more also said they would continue. This finding was not statistically significant χ^2 (1, $\underline{n}$ = 62) = .08, $\underline{p}$ < .52.

Table 8
PLANS TO CONTINUE BY AGE GROUP

PLANS	AGE GROUP					
	Under 30		30 or More		Total	
	%	(n)	%	(n)	%	(n)
Will not continue	22	(8)	19	(5)	21	(13)
Expect to continue	78	(28)	81	(21)	79	(49)
TOTAL	100	(36)	100	(26)	100	(62)

χ^2 (1, $\underline{n}$ = 62) = .08, $\underline{p}$ < .52

Gender

Gender did not affect plans to continue, as shown in Table 9. Equal proportions of males (79%) and females (79%) said they expect to continue the program in which they originally enrolled. The finding, however, was not statistically significant χ^2 (1, $\underline{n}$ = 62) = .01, $\underline{p}$ < .61.

Table 9
PLANS TO CONTINUE BY GENDER

PLANS	GENDER					
	Male		Female		Total	
	%	(n)	%	(n)	%	(n)
Will not continue	21	(10)	21	(3)	21	(13)
Expect to continue	79	(38)	79	(11)	79	(49)
TOTAL	100	(48)	100	(14)	100	(62)

χ^2 (1, $\underline{n}$ = 62) = .01, $\underline{p}$ < .61.

Correlates of Plans to Continue

A second statistical procedure was used to determine whether one or more of the following demographic characteristics were significantly related to respondents' plans to continue: age, employment status, gender, year of last enrollment, number of credits earned, and marital status. The above six factors were subjected to a step-wise multiple regression procedure (i.e., using forward selection) to determine which factors were most strongly associated with respondents' plans to continue. As shown in Table 10, two factors, year of last enrollment and employment, automatically were excluded from the analysis since neither met the entry criteria ($\underline{p}$ < .2000). As a result of these procedures, the following factors emerged as predictors of plans to continue: number of credits earned, marital status, gender, and age.

The multiple regression equation shown in Table 10 suggests several findings. First, total number of credits earned (F (1, n = 53) = 29.89, $p < .001$) appears to be the best predictor of plans to continue, at least among the six variables included in the step wise multiple regression model. Over one third ($R^2 = .37$) of the variation in plans to continue the degree program was explained by total number of credits earned alone. That is, as total number of credits earned increases by 10 units, likelihood of continuing also significantly ($p < .001$) increases by nearly one unit ($b = .90$). Marital status also appears to be an important factor with regard to continued study, one that was approaching significance ($p < .051$). As noted by the negative sign of marital status shown in Table 10 ($b = -.170$) single respondents were less likely to continue their education than were married respondents. In addition, the combined effect of total number of credits earned, marital status, gender, and age on plans to continue was 44% ($R^2 = .44$). Thus, nearly half of respondents' decisions regarding plans to continue are influenced by the combined effects of number of credits earned, marital status, gender, and age.

The results reported in Table 10 indicate that plans to continue are strongly affected by total number of credits earned, while less affected by gender and age. While the results show that the more credits a student completes in a degree program, the more likely he or she is to continue, it does not necessarily indicate that respondents who completed more credits will eventually fulfill all degree requirements of their original degree program.

Table 10
MULTIPLE REGRESSION ANALYSIS OF PLANS TO CONTINUE ON SELECTED DEMOGRAPHICS AND EDUCATION-RELATED VARIABLES (n=54)

			REGRESSION			
STEP	VARIABLE	ZERO-ORDER CORRELATION*	COEFFICIENT (b)**	F	CUMULATIVE R^2	PROBABILITY
1	Credits earned	.542	.090	29.82	.37	.001
2	Marital status	-.276	-.170	3.44	.41	.060
3	Gender	.050	-.130	1.54	.43	.221
4	Age	-.049	.043	1.11	.44	.298

* Zero-order correlations are based on all possible subjects for those two variables.

** Ten observations were delayed due to missing values, and therefore the total number included was 54.

CONCLUSIONS

What can institutional researchers glean from these findings? Overall, it is critical for academic administrators and faculty members to continue to maintain the academic standards and rigor of their higher education degree programs, without losing sight of the many circumstances that may prevent graduate students from successfully completing their degree programs. Of course, the answer to "How do we retain our graduate students?" varies with the policies, practices, and student characteristics of each institution. Nevertheless, these results identify why a small sample of respondents disrupted or discontinued their graduate studies: lack of time, limited funding, full-time job responsibilities, family responsibilities, and/or difficulty completing the required paper. Interestingly, more married respondents indicated plans to complete the degree program in which they originally enrolled than single respondents (p .051), suggesting that family members may provide the support needed to continue graduate degree programs.

Another important finding was that these respondents requested more guidance when initiating and pursuing a thesis. This request for assistance should not be disputed, as shown by the high proportion of graduate students (77%; $n = 49$) who said they expect to return and complete the degree program in which they originally enrolled. The assistance that administrators could offer them include: (1) formal academic orientation programs at the beginning of their program; (2) increased faculty advising, availability, and input throughout thesis writing; and (3) formal or informal thesis writing courses. Orientation programs could serve to identify the problems and pressures inherent in graduate-level study. Improved advising also might create improved communication between faculty members and graduate students thus enhancing student motivation. Organizing a formal thesis course helps graduate students comprehend the multitude of barriers to writing a thesis. The thesis course might go beyond the typical research methods approach by addressing effective library research, time and stress management techniques, and effective writing.

The results of this study show that respondents who completed more credits were significantly (p .001) more likely to expect to complete their degree program than those who had not. Therefore, institutional researchers might reconsider the importance of keeping graduate students on track throughout their educational careers.

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RETENTION -- THE ROLE OF INSTITUTIONAL RESEARCH

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INTRODUCTION

What is meant by the term retention? The dictionary defines "to retain" as "to keep in possession or use," or "to hold secure or intact." In higher education retention is generally used to mean that students are still enrolled (preferably intact) at some given point after they originally matriculate. Usually, the institution is interested in determining how many students it still possesses, and it may well call on an office of institutional research to make that determination.

The role of Institutional Research is, however, rarely as simple as counting how many students are enrolled now and dividing that by the number of students who started here a year ago. In order to provide comprehensive retention information to the decision-makers, Institutional Research must determine "(1) the degree to which (the institution) has a retention problem, (2) the particular student populations among which the problem is occurring, and (3) some of the reasons why the problem is occurring" (Ewell, 1984, p. 1).

Definition

The first task is to define the appropriate terms. Retention focuses on the students who stay, while attrition refers to those who leave. The retention rate plus the attrition rate equal 100%, and both are valid ways to measure the same phenomenon. Nevertheless, there are some differences in the way the two terms are used. By concentrating on students who remain enrolled, retention takes a positive approach. Once students begin to graduate, however, the retention rate may be misleading. For example, given a retention rate after four years of 15%, do we know what happened to the other 85%? Did they all graduate? Or none?

Attrition is unambiguous in that it always refers to those people who are not enrolled and who have not yet graduated. However, it is frequently applied only to those students who leave voluntarily, excluding those who are dismissed for academic deficiencies. Considering just the group of students who leave voluntarily, Ewell (1984) distinguishes three problems: the Unit-of-Analysis Problem, the "Stop-Out" Problem, and the Goal-Fulfillment Problem (p. 9).

Unit-of-Analysis: A student may withdraw from a course, a program, a particular school within a university, the entire institution, or from higher education itself. The last is difficult to measure and the first is not usually the focus of attrition studies. Attrition from a program may be of great interest, for example in determining whether students who leave Engineering fields go on to major in a science field. Nevertheless, program attrition rates may give an incomplete picture of overall attrition because they ignore students who withdrew without selecting a major field. This paper will focus on attrition at the institutional level.

Most institutions are interested in what percentage of students fail to reenrol in the institution. This is not the end of it, however, for a university with several undergraduate colleges. Students transferring from one unit to another within the university are lost to the first college but retained in the university. Attrition rates can be calculated using either original college or destination college as the base N, but in the latter case the base may change from semester to semester if students change colleges frequently.

The unit-of-analysis problem can be illustrated by the flowchart in Figure 1, which follows freshmen entering the College of Engineering of Rutgers University in the fall of 1981. The middle row shows the number of students enrolled in Engineering in each semester through the fall of the fifth year. The top row shows students starting in Engineering who subsequently enrolled in some other undergraduate college at Rutgers, and the bottom row shows Engineering students who are no longer enrolled anywhere in the University. The small boxes indicate students who have graduated.

From the University's point of view, the attrition rate for the College of Engineering after one semester is 35/718, or 4.9%. From Engineering's point of view, however, the college has also lost the 102 students who transferred to another undergraduate unit, so that the total attrition rate would be (102+35)/718, or 19.1% -- almost four times the other rate. After four years, 91, or 12.7%, of the original entering cohort were still enrolled in the College of Engineering, but a total of 171 (23.8%) were enrolled somewhere in the University. Thirty-six percent (257) of those entering Engineering had graduated from Engineering within four years, but 44.6% (320) had graduated from the University.

The stop-out problem refers to a pattern of enrollment behavior that includes leaving a given institution for one or more semesters between periods of enrollment--stopping out of the school temporarily rather than dropping out permanently. A student can only be identified as a stop-out, however, if and when he/she does return to the same institution. (Again, it is usually difficult to determine whether a student has subsequently enrolled in some other school.) Until that time, many institutions feel they have no alternative but to include all students not enrolled (and not graduated) in their attrition statistics.

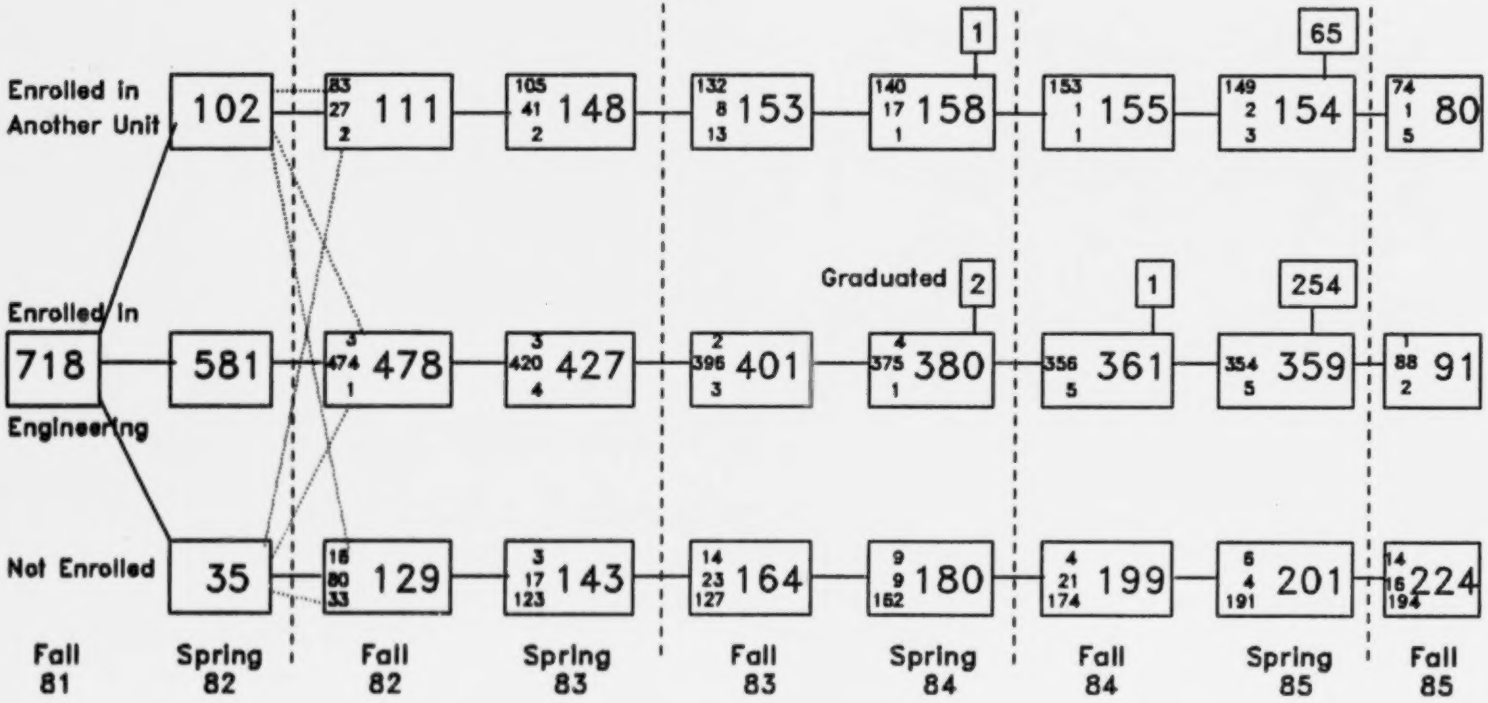
According to Ewell (1984), "The essence of (the goal-fulfillment problem) is that students withdraw from colleges and universities for both positive and negative reasons" (p. 10). Students may leave because the institution has failed to satisfy their needs somehow (for example in programs offered, advising, or social activities), or because their original goals (perhaps seeking training in a particular area but not including earning a degree at the institution) had been met. To ignore the latter explanation for withdrawal is to overstate the attrition "problem" a college or university may have. Is it desirable that the retention rate should be 100%? Or is there some minimum percentage of students who really don't belong at one institution in particular or in higher education generally?

It is also necessary to identify the students under scrutiny. "What is the retention rate for the class of 1989?" is an ambiguous question: does it refer to those entering or graduating in 1989? If the latter, does it matter when the students entered? Should full and part-time students be considered differently?

Figure 1

ENROLLMENT FLOWCHART

Freshmen Entering Engineering, Fall 1981


Enrolled in Another Unit
Enrolled in Engineering
Not Enrolled
Graduated
718
102
581
35
83 27 2 111
3 474 1 478
18 80 33 129
105 41 2 148
3 420 4 427
3 17 123 143
132 8 13 153
2 396 3 401
14 23 127 164
1
140 17 1 158
2
4 375 1 380
9 9 162 180
153 1 1 155
1
356 5 361
4 21 174 199
65
149 2 3 154
254
354 5 359
6 4 191 201
74 1 5 80
1 88 2 91
14 16 194 224
Fall 81
Spring 82
Fall 82
Spring 83
Fall 83
Spring 84
Fall 84
Spring 85
Fall 85

Note: bottom number in each box represents students moving into cell from bottom row; center number represents students coming from center row; top number represents students from top row.

What are other meaningful subgroups: gender? race/ethnicity? age? regular vs. special admissions criteria? athletes?

One must also decide when to measure retention: at the end of a semester? At the beginning of a new academic year? How is retention in a major field measured, if students are not required to declare a major when they enter? How long should students be tracked? At how many points should retention rates be measured (e.g., after every year or only after the first)?

While these questions may not be easy to answer, it is still possible and desirable for an office of institutional research to shed what light it can on both the scope of a college's attrition "problem" and its causes. The balance of this paper will offer some suggestions for types of data to be collected, formats for presentation, and research projects to be undertaken.

TYPES OF RETENTION DATA

Longitudinal data

Longitudinal enrollment data are extremely useful in documenting and understanding attrition. Does the college lose most of its total dropouts after one semester? after a year? after two years? The implications for probation and dismissal policies and for advising may vary considerably depending on when students tend to leave. Are students leaving after two years because they have been denied entrance to the upper-division program for which they chose the institution? At a college whose policy is not to dismiss students before the end of the freshman year do students in academic difficulty return for a second semester or withdraw?

Comparisons of different entering cohorts across time may also provide clues to retention programs that are more or less successful. An enrollment matrix, such as that shown in Table 1, permits comparisons across cohorts over a given interval (e.g., after one year), as well as within a single cohort over a more extended period (e.g., five to seven years). Such presentations can also enlighten discussions of trends among various subgroups, such as women, transfers, or students from underrepresented minority groups.

Graphic presentations of attrition data can sometimes illustrate a trend that is not as easily discernable from a page full of numbers. Helpful graphs might include one-year attrition by race/ethnicity; two to six-year graduation rates for transfer students, by type of sending college; five-year graduation by race/ethnicity and gender. Figure 2, showing the four to seven-year graduation rates of the Rutgers University day freshmen, indicates that the percentage of students taking longer than four years to graduate has been increasing (due in part to an increase in the number of students stopping out). Indeed, the University has recently decided to define the "normal" college stay as four-to-five years.

Survey data

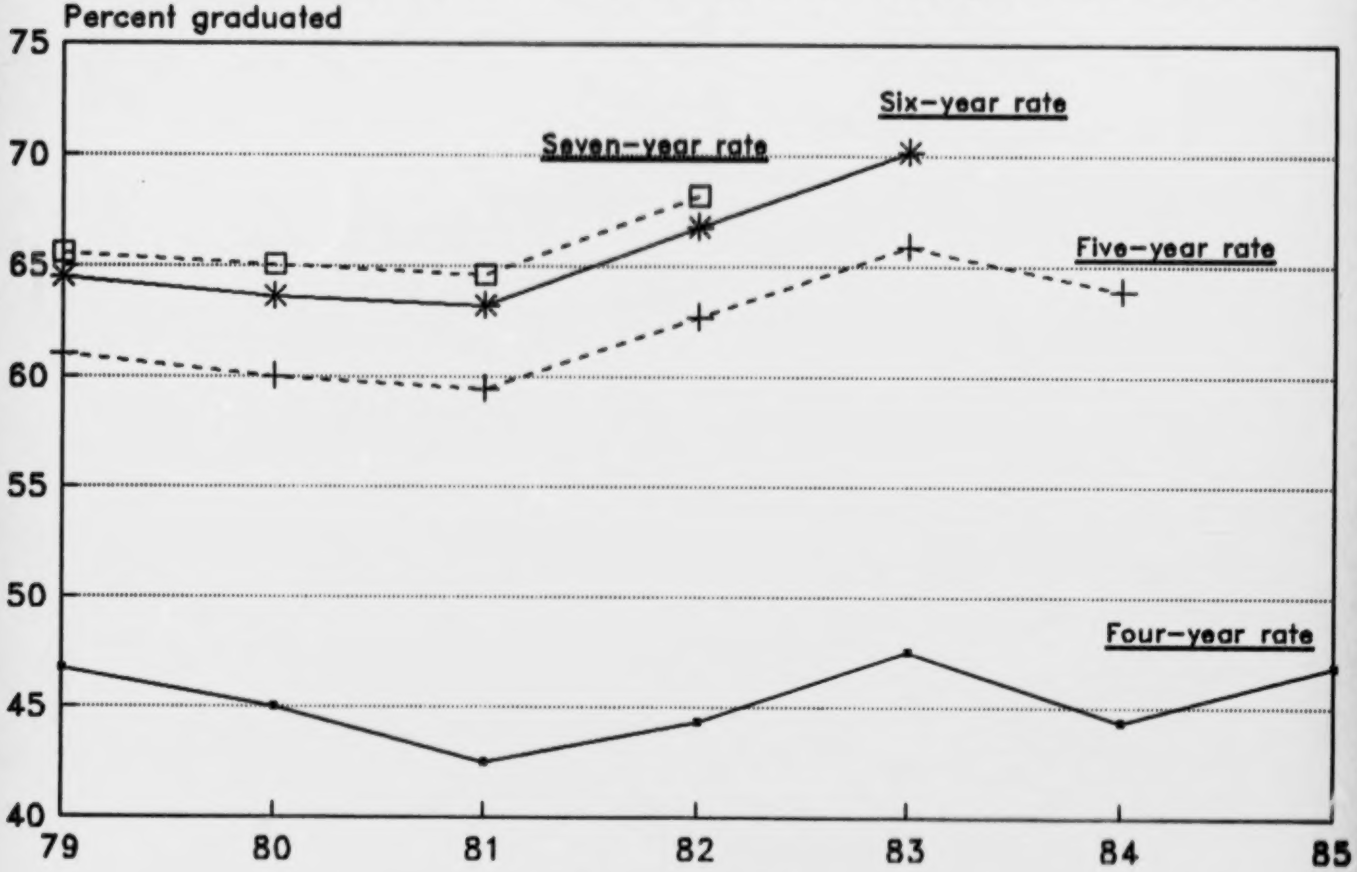
Surveys can be particularly helpful in discovering why students leave an institution. Satisfaction surveys may pinpoint what makes a student unhappy enough to leave. Table 2, for example, shows how student satisfaction at individual colleges of Rutgers University differs from the overall mean (these

Table 1
ENROLLMENT STATUS BY COHORT AND YEAR
Rutgers University Day Freshmen

Entering Cohort	1979	1980	1981	1982	1983	1984	1985	1986	1987
N	(6858)	(5812)	(6445)	(5947)	(5677)	(5606)	(6062)	(6207)	(5427)
Status									
After 1 year*									
% Enrolled	84	83	84	86	88	87	88	88	89
% Not Enrolled	16	17	16	14	12	13	12	12	11
After 2 years*									
% Enrolled	74	73	74	77	79	79	80	80	
% Not Enrolled	26	27	26	23	21	21	20	20	
After 3 years*									
% Enrolled	70	70	70	74	76	76	76		
% Not Enrolled	29	29	30	26	24	24	23		
% Graduated	1	1							
After 4 years*									
% Enrolled	20	21	23	25	25	27			
% Not Enrolled	32	32	33	29	26	27			
% Graduated	48	47	44	46	49	46			
After 5 years*									
% Enrolled	5	5	6	6	6				
% Not Enrolled	33	34	34	30	27				
% Graduated	62	61	60	64	67				
After 6 years*									
% Enrolled	2	2	3	3					
% Not Enrolled	33	34	34	30					
% Graduated	65	64	64	67					
After 7 years									
% Enrolled	2	2	2						
% Not Enrolled	33	33	34						
% Graduated	65	65	65						

* Fall of following year

Figure 2
FOUR TO SEVEN-YEAR GRADUATION
Rutgers Univ. Freshmen Entering Day Colleges 1979-1985



Entering Year

Table 2
College Deviation from Overall Percent Satisfied with Academic Characteristics

	Overall % sat. or very satisfied	COOK	DOUGLASS	ENGINEERING	LIVINGSTON	RUTGERS COLL.	UNIV. COLL.	NEWARK A&S
Quality of education	92	0	+ 2	- 4	+ 1	0	- 2	+ 2
Faculty commitment to teaching	83	- 1	- 2	-22	- 1	- 1	+ 1	+ 9
Preparation for occupation	73	+ 6	+ 1	- 3	+10	+ 2	+ 1	+11
Faculty attitude to students	76	+ 1	- 1	-25	- 4	+ 1	+ 1	+12
Variety of courses	74	+ 2	+ 5	- 3	+ 4	+ 5	-10	- 3
Advisor's familiarity with requirements	74	+ 3	0	- 1	- 6	- 5	+ 4	+ 2
Availability of library materials	73	+ 3	- 1	+ 2	+ 1	0	+ 9	- 7
Opportunity for practical application	67	+ 1	- 1	-13	- 2	- 4	- 3	+ 2
Faculty availability	75	+ 6	+ 5	- 8	+ 1	+ 3	- 8	+ 2
Grading system	81	- 4	0	-12	- 4	0	+ 6	+ 6
Class size	63	+ 2	- 3	-15	- 5	-14	- 9	+17
Variety of majors	83	+ 1	- 2	+13	0	+ 1	+ 1	- 2
Breadth of education	90	+ 2	+ 3	-13	- 1	+ 1	- 1	0
Library hours	85	+ 1	- 1	- 8	+ 2	- 4	+ 4	+ 5
Availability of advisor	65	+ 3	- 6	+ 5	+ 4	- 3	- 8	+ 4
Advisor considers student preferences	68	- 3	- 5	- 3	0	- 2	+ 2	+ 6
Training for graduate/professional school	85	0	- 3	- 8	+ 2	+ 2	- 3	+ 4
Graduation requirements	78	- 4	+ 7	- 2	- 7	+ 4	-14	- 1
Library staff	85	+ 6	+ 3	- 6	+ 2	- 1	+ 2	- 2
Library reserve system	81	+ 5	- 2	+ 8	+ 1	+ 1	+ 3	+ 1
Intellectual atmosphere	82	+ 4	+ 2	- 2	- 6	- 5	+ 6	+ 2
Opportunity to design own program	66	+ 1	0	-32	+ 2	+ 7	-13	+ 3
Opportunity for individual work with faculty	67	+ 2	- 4	0	- 2	- 1	- 3	+ 7
Opportunity for independent study	79	+ 6	+ 1	-10	- 6	+ 2	- 8	- 2
Probation/dismissal policy	87	- 5	+ 7	- 3	- 2	+ 1	- 4	+ 3

Boxed numbers indicate at least 5% more satisfied than overall.
Circled numbers indicate at least 5% less satisfied than overall.
Characteristics listed in descending order of importance to respondents.

results are taken from a 1985 survey of student satisfaction). Reading across the rows shows whether or not there is uniformity among the colleges on any given measure. For example, Rutgers students are fairly unanimous in their satisfaction with the quality of their education. Reading down the columns, on the other hand, indicates that students at the Newark College of Arts and Sciences are generally more satisfied than their New Brunswick counterparts, while students at the College of Engineering are much more dissatisfied with other aspects of their education than are students at other schools. Engineering students cite many of these factors as reasons for transferring from Engineering to another unit of the University.

Surveys of withdrawing students also provide valuable information, but response rates may be depressed by the students' emotions or by a desire to disassociate themselves from the perceived source of their problems. Table 3 illustrates some differences between students withdrawing from the College of Engineering at Rutgers University and the total group of withdrawing students: not only did Engineering students experience greater academic difficulty, but they were also more likely to consider affective factors (emotional problems, impersonal attitudes of faculty and staff) a major reason for leaving.

Related data

Institutional data files can shed additional light on matters of retention, as well. For example, dropouts and persisters can be compared in terms of admissions credentials (e.g., SAT scores, high school grades or rank). At a university it can be interesting to examine which colleges and/or majors are most likely to lose students -- or gain them: what percentage of students leaving Engineering go on to major in a science field? It can also be useful to look at the academic standing (GPA) of those who withdraw. The question might be asked in three ways: (1) What percent of those withdrawing leave in good standing (with a GPA of C or better)? (2) What percent of those in good standing withdraw? (3) What percent of those in marginal academic standing persist? The racial/ethnic comparison shown in Table 4 indicates that while most of the Black students who withdrew were in poor academic standing at the time, this University also lost a higher percentage of all the Black students in good standing than of the other groups.

TABLE 4

	Percent of Dropouts who Leave in Good Standing	Percent of all Freshmen in Good Standing Who Leave
White	48%	5%
Black	20	7
Hispanic	21	5
Asian	44	4

Institutional research can also shed light on many aspects of broader issues that relate to retention, for example, the topic of remediation. What percentage of entering freshmen require some kind of remediation? What proportion of those who do require remediation are retained into their second year? What proportion go on to graduate? How long does it take them? Are retention rates related to whether or not the students are permitted to enroll in college-level coursework at the same time as the remedial courses? If it is possible for a student to avoid removing a deficiency, how do such students fare later on?

Table 3
MAJOR REASONS FOR LEAVING RUTGERS UNIVERSITY
Engineering Students vs. Total Withdrawing Population

	ENGINEERING		TOTAL	
	% Major Reason	% Minor Reason	% Major Reason	% Minor Reason
Was suspended or placed on probation	48	(10)	14	(5)
Dissatisfied with my grades	38	(19)	14	(17)
Decided to attend a different college	33	(19)	24	(8)
Disappointed with the quality of instruction at this college	22	(25)	12	(14)
Experienced emotional problems	22	(11)	9	(14)
Impersonal attitudes of faculty and staff	19	(14)	11	(12)
Inadequate study habits	16	(22)	8	(17)
Academic advising was inadequate	14	(30)	11	(17)
Too many required courses	14	(22)	8	(10)
Tuition and fees were more than I could afford	14	(11)	17	(13)
Health-related problems (family or personal)	14	(3)	13	(6)

Source: American College Testing (ACT) Program, Withdrawing/Nonreturning Student Survey, conducted among students enrolled at Rutgers University Spring 1988 and not returning Fall 1988.

Another broad research topic might involve transfer students: How do retention rates of transfers compare to those of entering freshmen? To which group(s) of entering freshmen should the transfers be compared? Are retention rates related to the number of credits transferred, or to whether or not the transfer student enters with an associate's degree? Are transfer students satisfied with the transfer procedures, the acceptance rate for their credits, their expected time-to-graduation? How do GPAs at the new institution compare to those from the previous college? Why did the students transfer to the new institution? Were their expectations met? Were the institution's expectations met regarding level of preparation?

OTHER ISSUES

The role of institutional research in retention is not only to gather information on the subject but also to disseminate it effectively. Top administration needs the information for policy determination. Governing boards may need it for evaluation of the effectiveness of certain programs. Public relations offices can use it in news releases, catalogs, etc. Retention data can affect advising, staffing, course requirements, housing, and future admissions policies. While it may not be advisable or appropriate to distribute detailed analyses of retention data to all institutional staff, it may be helpful to prepare a summary of the data for fairly broad circulation. Sometimes this may come as a welcome surprise to people who didn't even know that institutional research existed or what it could offer.

As the capability for data analysis at the local (e.g. departmental) level grows on campus, so too does the likelihood of seeing conflicting data. While a certain amount of decentralization may be desirable, it is important that all parties involved in retention research have a common understanding of the definitions and issues involved. At Rutgers University, for example, the Registrar's Office has for years published yearly "retention" reports showing what percentage of those students who are eligible to return in the fall actually do so. This is useful in determining how many bodies will be on campus, but has limited usefulness in policy deliberations on such issues as remediation, advising, academic standards, grading practices, etc.

It is also important to help all parties understand the context of the information they derive. A sudden jump in attrition may be explained in terms of different characteristics of the entering groups, or it may be a function of tuition increases, changing academic requirements, etc. For transfer students, especially those from community colleges, changing practices in the sending institutions may also play a role.

In summary, the role of institutional research in retention is to help define the terms, identify the extent of the problem, document trends that may appear, understand the reasons for students' failure to persist, and in general be a resource for the many different parties in the institution who are concerned with the issue.

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AN INTERACTIVE MODEL FOR STUDYING STUDENT RETENTION

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Paper delivered at the Northeast Association of
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October 23, 1989

Abstract:

Student retention research has a long history in higher education, but only recently have research findings been synthesized to build theories of student withdrawal, to apply those theories to longitudinal and comparative studies, and to use the results to diagnose problems and devise strategies for increasing student retention. This paper describes the design of a microcomputer based decision support system for student retention research that uses an interactive modeling approach to conduct longitudinal and comparative studies using multi-year admissions, financial aid, and academic data integrated with student surveys of college adjustment, reasons for leaving, student involvement, and college experience.

Conceptual Framework for Design:

The conceptual framework for the design is based on recent reviews of the student retention literature (Tinto, 1987; Noel et al, 1983; Hossler, 1984; Pascarella, 1982). Tinto recognized the importance of the interactions that take place over time between individual students and the academic and social systems of particular colleges. A student's decision to pursue a degree at a particular college starts with the skills, abilities, interests, prior school experience, and family background the student brings to the campus, and his expectations about what he will experience as a student in that college. The motivation to persist towards successful completion of a degree in that college very much depends on the student's becoming involved in the academic and social life of the college, achieving a satisfactory academic record, and forming satisfying relationships with faculty, students and staff. Colleges vary widely in their admissions selectivity, intellectual orientations, academic demands, social life, and campus environment. Consequently, at any point in time, the college's requirements and academic and social climate may be a good match or poor match with the expectations of a particular student or student subculture.

From national longitudinal studies of degree attainment, it is clear that prestigious institutions that practice selective admissions have much higher rates of student retention and degree attainment. Furthermore, over the entire range of College Board SAT scores and high school class rank, academic measures are highly correlated with retention based on high and low admissions selectivity among colleges. (Dey and Astin, 1989)

Changing the admissions selectivity of a college requires a long-range effort to have any major impact on student retention; moreover, nearly 85 percent of the departures from college are voluntary, and most students leave in good academic standing (Tinto, 1985). Reasons for students leaving college vary widely and may be as difficult for an experienced counselor to interpret, as it is for the student, without adequate longitudinal data and significant dialogue about the student's adjustment, involvement, and response to academic and social life at the college (Anderson, 1985). In order to diagnose student retention problems and to devise effective intervention strategies, colleges administrators and institutional researchers need to build a comprehensive, multi-year longitudinal student database that incorporates both student records and student survey data. They also must have access to easy to use, flexible and powerful tools for performing analyses and reporting the results of student retention studies.

Methodology and Approach:

This paper describes the design and implementation of an interactive decision support system (DSS) that enables users to model attendance patterns and degree attainment for selected student subpopulations.

Using this DSS, longitudinal and comparative studies of retention were prepared for the 1984 entering student cohort for selected student subpopulations in each of the University's eight colleges. The implications of this interactive modeling system are discussed in the context of enrollment management and institutional research practice.

Research from the literature on student retention, together with a simple set of design concepts, guided the development of the student retention decision support system. The student tracking database for each student cohort was created by integrating data from each student's admissions application and financial aid records with each semester's attendance and grade performance record accumulated over a six year period. Academic prediction studies were performed using multiple linear regression to derive prediction equations and to determine the accuracy with which first semester grades can be predicted for each college subpopulation. Retention or withdrawal now can be monitored each semester for high academic risk student subpopulations to assess their academic adjustment.

A new survey instrument, Student Adaptation to College Questionnaire (Baker and Siryk, 1989), will be administered this fall to entering students several weeks into the semester to assess each student's academic, social, and personal-emotional adjustment, and his/her identification or attachment to the college and university.Data on student involvement will be gathered unobtrusively through student activity rosters and a student leadership transcript program. A follow-up survey will be sent to students withdrawing from the university each semester to obtain information about their reasons for leaving, and requests for transcripts will be monitored to learn about student plans for transferring to another college. Multivariate analysis procedures, including cluster, discriminant, and log-linear analysis, will be used to predict retention from traditional biographic/demographic and academic data and the student adaptation survey data gathered for freshmen and transfers in each college and for selected student subpopulations. Analyses will be performed using a decision support system that enables users to test hypotheses about high and low risk student subpopulations using simple menus and screens to select databases, student subpopulations and methods of analysis for each longitudinal comparison study.

Student Retention Tracking Database

The student retention database is created initially from Systems and Computer Technologies (SCT) Integrated Student Information System, which first became operational at the University in Fall, 1984. The student database that resides on the IBM 4381 mainframe includes student master records and detail records for each academic term, including data on prospective applicants, admissions applicants, student financial aid, student academic history, accounts receivable, and extracurricular activities. The mainframe database, while containing all of the necessary data elements for student retention tracking, is designed for efficiency in maintaining and viewing detail records for individual students, rather than being well integrated for flexible and responsive summary analysis and reporting.

Using a microcomputer based master data dictionary system, programmed in Foxbase, three Easytrieve programs are generated and uploaded to the IBM mainframe to select records and to format the necessary data fields for each academic term for an entering student cohort (e.g., all new full-time undergraduates entering in the fall term in 1984). The extracted records are down-loaded from tape to Bernoulli cartridge and imported through a Foxbase menu system to create the student retention tracking database. Using student social security number as the key for matching records, the applicant, financial aid, and student records are integrated to create the initial student retention tracking record. The student tracking record is processed through a Foxbase computation program that uses first semester accounts receivable data and student credit hours to validate which of the students who paid tuition deposits actually enrolled as full-time students in the entering cohort. Using social security number as the key, detail records for each academic term are then matched against each student master record to compute the student retention tracking history. Retention pattern variables are computed for each term indicating; 1) whether the student is enrolled full-time or part-time; and 2) whether the student is enrolled, not enrolled, has completed a two year degree, or has completed a four year degree.

The length of each retention pattern variable, created by concatenating the coded value for each semester across academic terms, is determined by the number of academic terms of data that are available for an entering cohort, for a maximum of six years or twelve semesters. The student retention record also keeps track of the student's college, major, credit hours and quality points earned, and semester and cumulative grade point average for each academic term the student is enrolled through graduation or departure during the six year time period.

Decision Support System

The Office of Planning and Institutional Research has developed a micro-computer based decision support system for college administrators that uses a report directory, data dictionary, and user-friendly menus and screens to control database and statistical analyses reporting, and to satisfy the user's information requirements with minimal programming assistance.

To execute a report request that already exists in the report directory, the user has only to scroll through organization, subject, and report menus, making a single choice at each menu level. A light-bar menu and up and down arrow keys are used to navigate through the report directory database to locate each menu choice. When the user's menu choice is highlighted by the light-bar, he hits the enter key to execute that selection. In the organization menu, the user selects the appropriate subject menu at the university, vice president, college, or department level, and enters the correct password to proceed to the next menu. From the subject menu the user selects student retention as the subject; this takes him to the report menu that lists all available student retention reports by student subpopulation, as requested at either the University or college level. Finally, the light-bar menu is used to scroll through the report descriptions to locate and highlight the user's selection, and the enter key is used to execute the analysis and produce the report the user has requested.

To create a new report request, or to modify an existing request, the user has only to enter the Common User Environment (CUE), a questionnaire type system of menus and screens, and respond to the prompts and questions on each screen.

The CUE questionnaire responses are saved as report request parameters in a single record, uniquely identified by a report name and report description, in the report directory database. When the report name and report description are highlighted and the user hits the enter key, the appropriate database file will be processed using the correct database analysis, statistical analysis, or report program - all executed under the control of the parameters the user has previously entered in specifying the report request.

The CUE questionnaire asks the user for a report name, the name of the database file used for input, the directory and subdirectory where the file is located, and for a descriptive report title. Organization and subject level classifications are assigned and entered for each report request. Using a data dictionary, available in the form of a report or screen views, the user specifies the data fields and criteria for record selection, data fields used for sorting or indexing records, and data fields used in the analysis or reports. Alternatively, the user can select records for processing by naming a key file where keys (e.g., Social Security Number, fund number) in individual records are matched against the list of keys in the named key file (e.g., Social Security Numbers for financial aid recipients) to create a selected records file or to produce the report directly.

The user is prompted to select a type of report (e.g., database, statistical analysis, report form listing) from a list of available options, to provide a descriptive report title, to name the data file where selected records will be saved, to name the database or statistical program (i.e., report format) to use, and to name the print file where the results of the analysis can be accessed through Executive Information System (EIS) menus.

Academic Prediction Studies

Traditional academic prediction studies are used as the first phase of an early warning system that deals with the student's academic adjustment. Although national follow-up studies indicate that institutional admissions selectivity, scholastic aptitude tests and high school class rank predict college grades and student retention, each college or university has to perform its own validation studies to determine the predictive value of traditional academic measures for admissions selection and student retention.

Multiple linear regression is the statistical method used to determine the optimum combination of weighted scores for predicting first semester grade point average from College Board SAT Verbal and Math scores and high school class rank. Having derived prediction equations (i.e., optimum combination of weighted scores for predictors), the equations are applied to each student's scores to obtain a predicted grade point average. The predicted grade point averages and actual first semester grade point averages are correlated in a cross-validation study to determine the predictive accuracy of the equations derived from the validation study.

Separate academic prediction studies are performed for freshmen in each college, because each of the eight colleges at the University is distinctive with respect to academic mission, curriculum, admissions selectivity, grading standards, and student retention. Fortunately, the CUE menu system makes it possible to select the student subpopulation for each college, to send the database to the SPSS-PC multiple linear regression program, to perform the necessary analysis, and to send the report results back where they can be viewed or printed from an EIS menu.

The first semester college grade point average is an appropriate measure of the student's academic adjustment during the transition period, and it correlates highly with the cumulative grade point averages of students who enroll in subsequent semesters. The problem for the University of Hartford is that first semester GPA can be predicted from SAT scores and high school class with reasonable accuracy (.50 to.65 multiple correlation) only for freshmen in four of the eight colleges. Data on SAT scores and prior college grade point averages are too incomplete to perform a reliable academic prediction study for transfers. Moreover, the large majority of students who leave the University are eligible to return. Some do have marginal grades, but others have grades that qualify them for transfer to highly selective colleges.

Student Adaptation to College

Student retention is a multifaceted process that can be understood only when information the college has about the student's biographical, demographic, and academic data are supplemented with surveys that enable students to share their perceptions about what they are experiencing in their adjustment to college life. During the early period of college, students experience a separation from their families, high school peers, and communities, and go through a period of transition before they can incorporate and feel comfortable with the values, attitudes, norms, and behaviors of the student subculture and the college they have selected (Tinto, 1989).

To supplement the information available for studying student retention, the University has selected a recently published questionnaire that was designed specifically to assess student adjustment to college, the Student Adaptation to College Questionnaire (SACQ; Baker and Siryk, 1989). SACQ is a 67 item, self report questionnaire that can be administered individually or in groups, and takes about 20 minutes to complete.

The questionnaire is organized into four principal subscales, each of which focuses on a different aspect of student adjustment: 1) Academic Adjustment (24 items) deals with educational demands of the college experience; 2) Social Adjustment (20 items) pertains to interpersonal and social demands of college adjustment; 3) PersonalEmotional Adjustment (15 items) refers to how the student is feeling psychologically and physically; and 4) Goal Commitment-Institutional Attachment (15 items) explores the student's feelings about being in college and attending the particular college he/she selected.

SACQ is being administered at the University under the direction of the Counseling Office to all freshmen and transfers entering in the Fall, 1989. A pilot test of the unpublished version of the instrument was given through the Art and Sciences Dialogue program a year ago, and preliminary research findings were encouraging in predicting student retention over the first two semesters. As the authors of SACQ have suggested, the Office of Planning and Institutional Research will conduct its own local validation studies following guidelines suggested by the research at Clark University. When the SACQ database is complete, a factor analysis will be performed to compare the locally validated factor scales with the factor scales used in scoring the instrument. Cluster analysis will be performed to create student subgroups that have similar adjustment profiles across the four scales and to identify high and low risk populations for student retention. Discriminant analysis studies will then be conducted to identify scales and items that predict group membership for: 1) different adjustment profiles, 2) high and low risk groups for student retention, 3) students continuing and leaving, 4) freshmen and transfers in each college. The SACQ database will also be integrated with the student retention tracking database which will make it possible to use interactive computing to perform statistical analyses or ad hoc queries for student subpopulations selected using any combination of predictors or criteria in the database.

Reasons for Leaving

Since over 85 percent of the students who leave college are in satisfactory academic standing when they leave, it is important to gather data on the student's reasons for leaving, either during the student's exit interview or as soon as possible after it becomes known that the student is leaving. When students are being counseled about their leaving, the counselor needs to discriminate between those situations where the student's educational, career, and personal goals are really better served by leaving or transferring to another college, and those situations where the institution is in a position to respond effectively, thus enabling the student to decide to continue his/her enrollment. If the institution is to take effective action, it needs to understand the types of adjustment problems students are having and why they decide to leave, not just to describe the biographic, demographic, academic, or extracurricular differences between students who stay or leave.

The University has administered surveys to departing students in the past, but now plans to revise that instrument to reflect recent research findings, to administer the instrument more systematically to increase response rates, and to incorporate reasons for leaving more directly into the student retention research program. A well balanced "reasons for leaving" questionnaire should present a comprehensive and representative list of reasons; one that parallels the factors encompassed in the Student Adaptation to College Questionnaire - academic, personal, social, and institutional reasons for leaving.

The questionnaire should also make provisions for identifying how important each reason is to the student's decision to leave, asking the student to rank the three most important reasons for leaving, and using an open ended question asking for the student's impressions of his/her college experience.

Student Retention Patterns

Student retention patterns are analyzed using the CUE system of menus and screens and interactive computing to describe the retention patterns for user defined subpopulations of students in any entering cohort. The user only has to select the student retention database for the entering cohort, enter his selection criteria for selecting the student subpopulation for analysis, and the name of the Foxbase program that computes the pattern of enrollment and degree completion. The analysis program computes two tables in the same format. The rows are enrollment status and degree completion, and the columns are fall and spring semesters up to a maximum of six years of tracking data. The first table displays the number of students in each enrollment status and degree completion category by semester. The second table reports the percent of the entering student cohort in each enrollment status and degree completion category by semester.

Separate analyses of student retention are performed routinely for freshmen and transfers in each college to establish a base-line and to monitor progress in efforts to improve student retention. In the interest of brevity, we report only the patterns for all colleges combined. For the 1984 entering freshmen student cohort 46 percent had either earned a four-year degree or were still enrolled at the end of the fourth year. For transfers in the 1984 entering cohort 60 percent had either earned a four-year degree or were still enrolled at the end of the fourth year. Between 15 and 20 percent of the entering student cohort was lost during the first year, and another 15 to 20 percent in the second year, after which only between 5 and 10 percent leave. Based on national student retention data reported in (Dey and Astin, 1989), the University's student retention rate is normative for private, comprehensive universities of moderate admissions selectivity.

However within the student enrollment mix of freshmen and transfers at the University, there is wide variation among colleges in student retention rates (35 percent to 67 percent) not all of which is explained by differences in admissions selectivity.

The advantages of using interactive computing to assess student retention patterns is readily apparent. Hypotheses about high and low risk student subpopulations can be tested by using any combination of variables in a user defined record selection statement and performing the student retention analysis for that subpopulation in a matter of a few minutes directly from the database without having to write a program. For example, the user could compare the student retention patterns of freshmen receiving financial aid in the college of arts and sciences with first semester GPA's above 3.0 with those having first semester GPA's below 2.2, to determine if the college is relatively successful in retaining its better students. Similarly, the user could compare the student retention patterns of students identified as high and low risk based on student responses to the Student Adaptation to College Questionnaire (Baker and Siryk).

Student Involvement

Astin and Pace have argued persuasively that active student involvement is the key to learning and personal growth in college, to student achievement and satisfaction, and as a result to student retention. (Astin, 1984; Pace, 1984) Their model of student involvement is as promising a research paradigm as any currently available for studying student retention. Research has demonstrated rather clearly that the breadth and quality of student involvement in selective liberal arts colleges and research universities is highly correlated with perceived gains from college experiences, with student satisfaction, with high student retention, and with high rates of alumni participation. (Pace, 1984; Astin, 1984) Relatively few colleges and universities have the admissions selectivity, the physical facilities, the quality of academic programs and student services, or the housing, athletic and extracurricular facilities to match that high level of student involvement and quality of effort. But within the limits of its own resources, and the students it recruits, every college can seek effective ways to motivate its students to become more actively involved in their own learning and personal growth.

Creating an environment where students are actively involved begins with student recruitment; identifying students who are interested, actively involved, and committed to improvement in some area of activity the college offers. For colleges that are moderately selective academically, it means finding students whose academic interests and abilities match the college's teaching strengths, and whose extracurricular interests and abilities match the college's offerings for student life. The student has to be sufficiently motivated to invest in his/her own learning; that is the student's responsibility. Given the resources the college has to offer, the college at the very least can help the student make the interpersonal and activity connections that build on motivations that are already there.

The University currently is exploring ways to study the impact of student involvement in extra-curricula activities and how that participation contributes to academic achievement, satisfaction with the college experience, and student retention for different student subcultures. Activity codes in the ISIS database can be downloaded for prospective students, applicants and enrolled students to track involvement in extracurricular activities. With this database it is possible to identify new students and returning students who share common interests, to help them to connect, and to pursue their interests actively while building friendships. The same activity database will be valuable for recruiting students for participation in extracurricular activities, for building a leadership transcript for students, for responding to NCAA compliance in monitoring intercollegiate athletics, for studying the impact of financial aid programs on student mix, and for assessing the impact of activity involvement on student satisfaction and retention.

Quality of Student College Experiences

Institutional effectiveness in student recruitment and retention ultimately depends on the perceptions prospective and enrolled students have of the quality of academic programs, administrative services, and physical facilities, and the feelings of stimulation, friendliness, warmth, and support that come from relationships with faculty, staff and fellow students.

Colleges and universities concerned about improving quality recognize the need to ask students to share their perceptions about the quality and value of their college experience. At the University of Hartford each college uses an instrument to gather data on student evaluations of instruction. Such instruments provide useful feedback to individual faculty members and department heads which helps them to increase teaching effectiveness within the department. With appropriate levels of summarization, student evaluations of instruction can also make a valuable contribution to improvement through program level reviews.

The American College Testing program has developed two survey instruments that appear promising for gathering student evaluations on the quality of the campus environment, physical facilities, and administrative services: 1) College Student Needs Assessment Survey, and 2) Student Opinion Survey. Questionnaires of this type should be especially useful as the University gathers data for an accreditation review which will take place within the division of student affairs next year.

The College Student Experience Questionnaire (Pace, 1984) is a unique self-report instrument for gathering data from students about the quality of their undergraduate education and examining the sources of student progress towards important goals of a college education. The instrument has a behavioral orientation the asks students how frequently they participate in each of a comprehensive list of learning activities which are widely available on college and university campuses. Quality of effort is measured by arranging the activities into hierarchical scales, with individual activity items at higher or lower levels on the scale depending on the time commitment and level of difficulty the activity represents. The student also is asked to assess the quality of his/her undergraduate experience and the progress made toward achieving important educational objectives. At the University of Hartford we plan to administer the College Student Experiences Survey as a senior survey for three purposes: 1) to perform an assessment of academic outcomes and administrative services, 2) to gain a better understanding of the benefits students gain from their activity involvement, 3) to stimulate student thinking about how to relate their undergraduate experience to careers and life after college, and 4) to identify students whose involvement as undergraduates suggest that they will be active contributors as alumni.

Executive Information System

The Executive Information System (EIS) is a user-friendly system of menus and screens designed to enable decision makers at the University to navigate through a comprehensive strategic planning and management information database to monitor external trends and institutional performance. Access to information is provided by linking report files to a light-bar menu system that is implemented using Lotus spreadsheet software.

To access information, the decision maker has only to scroll through organization, subject, and report menus, making a single choice at each menu level. A light-bar menu and up and down arrows are used to navigate through the reports that are available for viewing or printing. When the user's menu choice is highlighted by the light-bar, he hits the enter key to make his selection, and the requested information is immediately retrieved for viewing.

To illustrate the ease-of-use, flexibility, and power of the EIS system, here is an example of how a decision maker might use the system to gain a better understanding of student retention on his campus. The Vice President for Student Affairs uses the light-bar menu to select the University level of the organization menu. At the subject level, he selects "strategic plans" as the subject. He browses the enrollment management section of the University's strategic plan to review what the student retention situation is in each college. He navigates his way back to the subject menu and selects "student retention reports"; and from the list of available reports he proceeds to select and review student retention reports comparing a six year follow-up of freshmen in the 1984 entering student cohorts of Arts and Sciences with their counterparts in the College of Engineering. Having observed the differences in student retention rates between the two colleges at the end of the first semester, the vice president navigates his way back through the organization and subject menus to review the academic prediction studies of each college.

He can then judge how accurately first semester grades can be predicted, and consider whether raising admissions standards might improve academic adjustment. The narrative interpretation and tables from that study suggest that higher admissions standards could improve retention, but it is not clear whether the students the colleges are losing are at the high or low end on academic performance. Returning to the subject menu again, he reviews the available student retention reports and sees that the type of analysis he wants has not been performed. The analysis he wants is only a telephone or electronic message away from the Office of Planning and Institutional Research or the Director of Counseling Services. By simply changing the record selection criteria in a couple of the decision support system report request screens the new information request can be processed in a matter of minutes, with the resulting reports accessible for review through the EIS menus when the report is produced. Using the same procedures, the decision maker can: 1) view or print the results of any database or statistical analysis report; 2) use a spreadsheet model to ask "what if" questions, to print tables, or view graphs; 3) retrieve the text of strategic plans, annual reports, budget requests, committee reports, or institutional research studies; 4) review external trends and internal performance indicators in the form of tables, graphs and interpretive text.

Summary and Conclusions:

This paper presents an overview of a design for improving the quality of information available for continuous operational study of student retention at the University of Hartford. The theoretical and conceptual frameworks currently available clearly are useful for the design of a comprehensive database for conducting longitudinal and comparative studies of student retention. The University is fortunate to have access to a comprehensive operational student database, and to a cost-effective decision support and executive information system that promises to deliver better and more timely information to decision makers. A successful student retention research program, however, requires more than operational student data. The database must be enriched with student surveys to provide feedback on student college adjustment, reasons for leaving, and quality of college experiences. Improvements will have to be made in our survey research system to provide feedback that is timely, not only for purposes of research but for operational use in improving student recruitment and retention strategies.

As in any research effort of this type, the University recognizes the importance of maintaining the security and confidentiality of individual student data, balanced against the necessity of providing information access to professional administrators, student counselors, and faculty advisors who have the responsibility of helping students take maximum advantage of the undergraduate experiences the college offers.

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THE VIABILITY OF A ONE-PERSON RESEARCH OFFICE IN A DEMANDING ENVIRONMENT

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INTRODUCTION

I truly represent a one-person research office! I announce this immediately to separate my status from that of colleagues who might refer to themselves similarly, but who, in actuality, have a secretary or data entry support or a part-time research associate or a graduate student or some other body in the department who can provide help, even if the contribution is only to stuff envelopes or look up zip codes. At the college where I work, the Institutional Research Office does not warrant even part-time support staff.

PURPOSE

I don't mean to disillusion any newcomers, but not all of us in Institutional Research have power or glory or even ready access to the key decision makers at our institutions. Since this describes the status of research at my institution, the purpose of this paper is to offer hope and encouragement to those who might find themselves in a comparable situation. When I first joined the research field 2-1/2 years ago and read some of the institutional research literature and attended my first research conference, I was in awe of some of our colleagues who seem to have the ear and the respect of their institution's president and who are at the forefront of the policy-making and planning process. I was inspired! I was excited! But then I assessed the position at my institution and reality set in.

Some of us may never have a chance to recommend actions based on our findings; our input is neither sought nor welcome Some of us may not even have access to all the data we need on campus. Being an institutional researcher is not a prestigious or glamorous role for all of us. Some of us may be our organization's work horse--laden with numerous tasks but no authority. If some of you are in that position, take heart. The work can get done effectively, without sacrificing sanity.

ANATOMY OF A RESEARCH OFFICE

Realizing that research offices are organized in a myriad of ways, let me describe briefly the anatomy of the Institutional Research Office at Lehigh County Community College, a commuter college serving Lehigh (population 288,700) and Carbon (population 56,100) counties in Pennsylvania. Enrollment includes approximately 3,500 credit students and 12,000 noncredit students. My position reports to an executive dean in the noncredit division of the college. As you might imagine, the location of

Institutional Research in this division is not without inherent problems, which will be addressed later. My supervisor reports directly to the president whom I almost never see, except in the corridors.

DISADVANTAGES

Are there disadvantages to running a one-person research office, especially one that is not accorded the status granted to other departments in the institution? You bet there are! To begin with, we individuals without access to the president and key players do not get priority information. All projects are received secondhand. For example, my supervisor hears requests from the president or board of trustees and later passes these requests, in some form, on to me. Thus, I haven't the faintest notion of what may have brought about the need or desire for this particular piece of research, or how my data will be used. I receive very little, if any, feedback on the ultimate results of my work. One time I actually found out by reading the local newspaper!

In addition, the requests that we obtain indirectly may not be clear and definable; information needed often is overlooked during the initial request and we may have to redo a project several times as the users think of other bits of data they would like to have included--but by the original deadline. If this happens frequently, we quickly learn to anticipate extra work and plan our projects accordingly.

Other disadvantages--yes, there are more--include the tensions that may exist simply because of where one's Institutional Research Office is located on the organizational chart. Using my college as an example, since I report to the individual who heads the noncredit division, Institutional Research is sometimes perceived as being a part of noncredit and thus perhaps slanted or out of the academic mainstream.

Another concern shared by researchers who run their offices under similar conditions is the lack of initial input and lack of veto power over research requests. Usually we are not able to decide what our top priorities should be, since all projects assigned to us are deemed to be top-priority items. Without control over research requests, we may find ourselves doing research customarily done by academic departments in other colleges. An example of this may be feasibility studies to justify new academic programs that are under consideration in various departments. Instead of serving in an advisory capacity, providing assistance to the pertinent departments doing the research, we may be asked to perform all facets of the research ourselves. A presenter at a research conference I attended earlier this year described the ideal Institutional Research structure as one in which the director reports to the president and has the authority to veto research requests. Maybe that's the heaven where good researchers aspire to go when they leave their offices on this earth!

Perhaps the biggest disadvantage to being the only person on campus responsible for the research function is the non-productive use of our time. As I explained earlier, Institutional Research at my college does not have clerical support assigned to it. Nor does the college's data center write computer programs or do data entry. Therefore, a number of days are spent searching for out-of-town telephone numbers or zip codes or names of key business leaders; other days may be consumed by folding surveys and stuffing envelopes, while visions of pending deadlines loom overhead, providing distraction from smarting paper cuts.

ADVANTAGES

Lest I have frightened anyone just recently hired to run a one-person research office, let me hasten to say that there are advantages to being in our position. Really! For example, we learn to DO IT ALL. We have to! Unlike larger research offices which may have someone who writes the SPSS programs, someone who does data entry or recodes surveys, someone who constructs survey instruments, someone who analyzes the data or writes the final reports, we become proficient at all those tasks and ultimately attain much broader experience than one who specializes. Every step of every project--from its conception to the completion of the final report--is ours, not to oversee, not to delegate, but to perform!

Boredom is unheard of in a one-person research office. In fact, sometimes time speeds by too quickly; a coworker may have to appear and remind us that it's time for lunch or, even worse, that it's time to go home. On occasion, the cleaning lady has come in at night and asked whether I'd brought my pajamas and toothbrush!

WORK LOAD

What kinds of projects can a one-person research office expect to handle? The list undoubtedly closely parallels a list of projects undertaken by larger research offices. We may be called upon to develop and conduct alumni studies, employer surveys, transfer studies, student satisfaction surveys and developmental program longitudinal studies; we are asked to produce a factbook, write grant proposals, develop community attitude studies, do needs assessments, and perform minority population research. We create retention studies, student profiles and assessment test comparisons; perhaps we conduct specialized studies like substance abuse awareness surveys, Title III program evaluations, academic program feasibility studies or economic impact studies. The list of projects completed by this particular one-person research office continues at the end of the paper. As the list illustrates, when comparing projects, one-person research offices closely resemble larger research offices. The assignments, the responsibilities and even the time allotted for completion of the projects may be identical. Only the manpower to accomplish them differs.

TECHNOLOGICAL AIDS

That leads us to the big question so often asked of researchers in one-person offices. How do we get the work done? What techniques or technologies can we use to overcome the lack of support staff? Without the luxury or security of anyone to delegate work to, a researcher in this position needs to maximize time in order to juggle multiple demands.

One of the best ways I have found to manage time is to monitor time--the time it takes from the conception to the completion of a research project. I do the initial tracking on a daily desk calendar by noting the various projects I worked on that day and the amount of time spent on each. Then when a project is completed, I leaf through the calendar and add up the total hours spent on it. I go a step further and also note the multiple tasks that were involved in completing each project--from meetings and telephone contacts to data entry and stuffing envelopes. This written tracking system, however simplistic, would be sufficient to provide an excellent portrait of the amount of work required for each research project, and is especially useful if a researcher plans to conduct similar types of studies in the future.

Software packages may also be used to facilitate project tracking. Two that come to mind immediately are the Artemis bar chart tracking system, which I used to produce the graphic timeline that follows, and the Harvard Total Project Manager, which tracks the resources and durations of all research projects entered in the system. While both Harvard and Artemis can be useful in monitoring research projects, they do require a major investment to purchase, learn and implement the software. Lehigh County Community College does not have project management software; the Artemis software used for displaying the research projects undertaken by my office belonged to a friend at an engineering firm.

Monitoring the time expended on research projects can be helpful in managing an institutional research office. The system can be used as a planning tool to set deadlines, measure progress and keep multiple projects moving along. The timeline clearly indicates, at a glance, whether another project can be undertaken at the present time and how its deadline will affect the completion of other projects already in progress. Of course, be forewarned that having the benefit of such technology may not be useful to a researcher whose supervisor's philosophy is that there is always time for one more project, regardless of what the computer may indicate.

Tracking our research projects is beneficial, of course. But what other tools can a researcher from a one-person office use to make his or her job more manageable (and less stressful)? To begin with, statistical software such as SPSS or SAS is a significant timesaver, especially if the research office conducts a lot of surveys. My institution did not have a statistical software package when I began working as the institutional research officer 2-1/2 years ago, and I can still remember hand-tabulating over 175 responses to a detailed retention survey. Fortunately, that project took place during the summer and I was able to borrow my bored 11-year-old niece and put her to work making tick marks on a master copy of the survey. We've come a long way since that time, and SPSS technology has greatly simplified such tasks. Not only does it provide frequencies, percentages, means and the other commonly requested statistics that researchers like to include in reports, but it also completes more complex executions with relative ease.

Other software applications that can enhance the research projects we produce include various graphics packages. Most administrators, presidents and trustees are impressed by bold graphics. Because of their full schedules, these individuals don't have time to read lengthy reports and columns of data. But present that same information on a bar or pie chart or line graph, and we're guaranteed an audience! My office relies on Microsoft Chart to produce sharp graphics that display the information in a form that can be digested quickly by the reader. Graphic formats are especially useful for comparative data--for example, for presenting employer or alumni responses to the same question over several years, as shown on the attached sample. Graphics software can also be used to produce striking, attention-grabbing covers that separate our research reports from the other stacks of paper piling up in mail baskets.

ADDITIONAL RESOURCES

Most researchers, especially those in one-person offices, would agree that statistical and graphics software packages are absolute necessities in an institutional research office, saving not only time, but simplifying our multiple tasks. But what other resources can we rely on to make our professional lives easier? Don't forget county and city offices, employment offices, the census bureau, state data centers, state departments of labor or departments of education. Oft times one telephone call can save hours of poring over library materials or calculating statistics.

Another essential resource not to be overlooked is people. Don't underestimate the valuable contributions that others can make. Remember, those of us in one-person research offices need every bit of help we can muster. In addition to providing obvious support, like assisting with typing or searching for data in library directories, they can be a wonderful source of ideas for research studies. Conversations with individuals in business can yield excellent concepts that we can parlay into employer survey questions. I once solicited scores of candid comments about the college from almost everyone I happened to see over a two-week period, and from their diverse statements a 33-question community attitude survey was developed to assess the public's perception of the college's image and function.

CONCLUSION

Utilizing both human and technological assistance is vital in helping us achieve success in a multiple-demand situation. Manning a fast-paced one-person research office takes superior planning and organizing skills in order to avoid feeling bogged down and frustrated. We need to be prepared to accommodate changing priorities and last-minute projects; we have to be able to perform under pressure, while maintaining our perspective and enthusiasm.

As we see ourselves juggling a variety of tasks and projects simultaneously and getting them done--done right and on time--we can derive great satisfaction from our accomplishments. Managing multiple priorities is a challenge. But we not only manage, we succeed. So to those of you in a one-person research office, take a good look at all that your office has achieved. Isn't it truly amazing what one person can do?

LIST OF PROJECTS UNDERTAKEN BY INSTITUTIONAL RESEARCH OFFICE

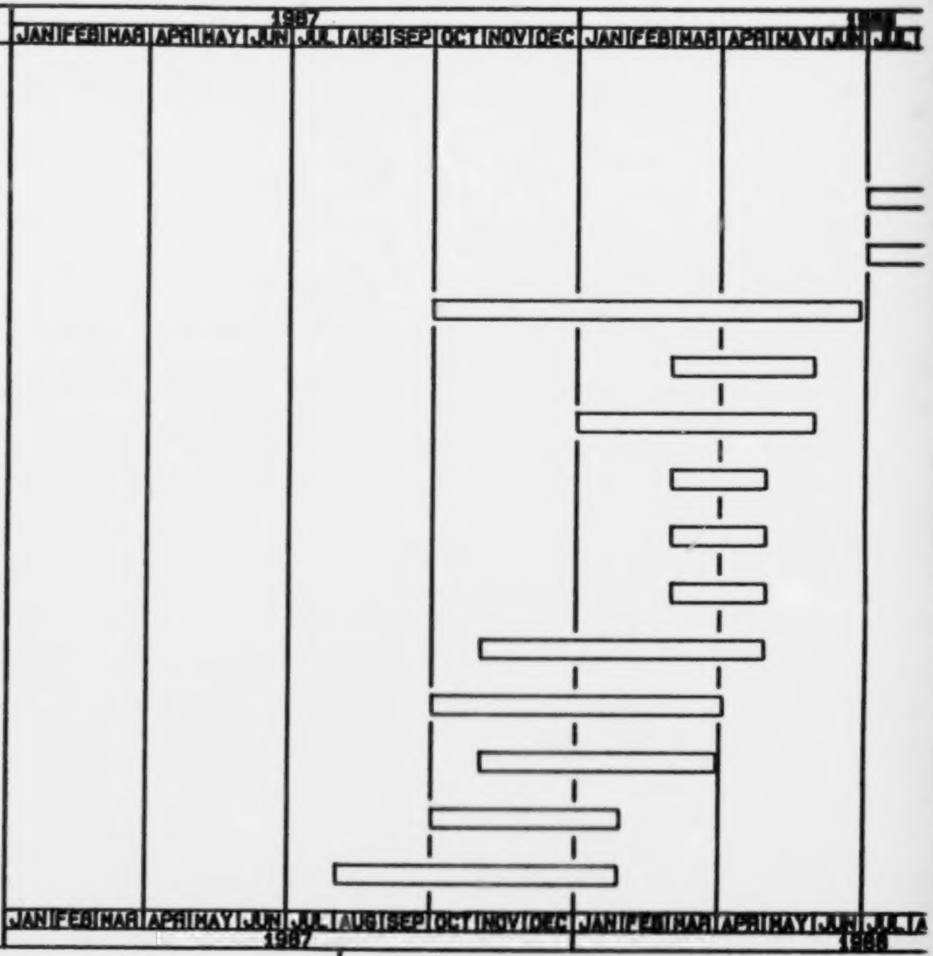
- Student Satisfaction Survey
- Contracts and Grants Project Report (Monthly)
- Transfer Study
- Substance Abuse Survey
- Survey of Employers - 1987 Graduates
- Academic Program Development Research (Feasibility Studies)
- Title III Evaluation Report
- Performance/Compliance Reports for Vo-Ed Grants
- Minority Population Research
- Novell NetWare Grant Proposal
- Update College Fact Sheet
- Facts and Figures 1989 (Factbook)
- Alumni Study - Class of 1986
- Comparison of Assessment Test Scores by School District
- Academic Audits Research - 13 Programs
- Adult Basic Education Literacy Grant
- Profile of Students From Nonsponsoring School Districts
- Survey of Employer Interest in Applied Communications Program
- Employment Opportunities in Aviation Maintenance and Avionics
- Emeriti Status at Pennsylvania Community Colleges
- Law Library Research
- Developmental Program Tracking Study Addendum (Math)
- Lehigh County Community College Organization Membership List
- Yellow Freight Proposal
- Career Workshop Questionnaire for Admissions Office
- Survey of Community Interest in New Academic Programs
- Facts & Figures - 1988
- Comparison of Assessment Test Scores - Fall 1987 and Fall 1988
- Profile of LCCC Graduates
- Survey of Employers - 1986 Graduates
- Survey of Prison Population
- Developmental Program Longitudinal Tracking Study
- Feasibility Study - Aviation Program
- Alumni Survey - Class of 1985
- Telecommunications Grant
- Industrial Automation - Robotics Grant
- Wellness-Based Substance Abuse Prevention Program Grant
- Pennsylvania Community College Noncredit Survey
- Community Attitude Survey
- Facts & Figures - 1987
- Survey of Students Attending City Site
- CLEP Test Administration and Report - English and Math Competencies
- Rodale Wellness Grant Proposal
- Fall Enrollment Report - 1987
- Report on Aging Population
- National Sabbatical Survey
- Operations Manual - Institutional Research Position
- Pennsylvania Community College Sabbatical Survey
- Veterans Outreach Program--Grant Proposal Assistance
- Middle States Report
- History of Enrollment and Graduate Statistics
- Former Student Survey (Retention)
- Nursing Program Research/Survey Development
- Administration Evaluation
- Drug Prevention Grant
- Edit/Revise Brochures for New Academic Programs
- Economic Impact Study
- Computerizing Technical Writing Grant
- Adult Basic Education Through Vocational Simulation (Grant)
- Mechanical and Electronics Technology Graduate Questionnaire
- Assist Development of Faculty Survey on Program Assessment
- Basic/Developmental Program Tracking Study
- Child Care Occupational Research
- Institutional Research Reviews
- Compile Institutional Data for Data Exchanges/Directories
- Student Profiles for Selected Academic Programs
- Review/Recommend Outcomes Assessment Instruments/Methods

Bonnie L. St[illegible]nk
Institutional Research and Grants
Administration Officer
Lehigh County Community College

Artemis Bar Chart Timeline -- Sample Section

PROJECTS COMPLETED BETWEEN FEBRUARY 16, 1987 AND M

Project Description	Approx. Hours	Code
COMPARISON OF ASSESSMENT TEST SCORES - FALL 1987 & FALL 1988	19	AEFGJP
PROFILE OF LCCC GRADUATES	13	EGJPR
SURVEY OF EMPLOYERS - 1986 GRADUATES	176	ABCDEFGH IJKLMNOP QTUWX
SURVEY OF PRISON POPULATION	15	ABCDHI
BASIC/DEVELOPMENTAL LONGITUDINAL TRACKING STUDY	93	ABCEFGHJ PSUV
FEASIBILITY STUDY - AVIATION PROGRAM	40	ABCDEFGH JKOTUVX
ALUMNI SURVEY - CLASS OF 1985	100	ABCDEFGH JLMNOPQT UX
TELECOMMUNICATIONS GRANT	12	ABCEGHX
INDUSTRIAL AUTOMATION - ROBOTICS GRANT	12	ABCEGHX
WELLNESS-BASED SUBSTANCE ABUSE PREVENTION PROGRAM GRANT	35	ABCEGHVX
PENNSYLVANIA COMMUNITY COLLEGE NONCREDIT SURVEY	22	ACDEFGHJ OPQTU
COMMUNITY ATTITUDE SURVEY	125	ABCDEFGH IJKLMNOP QTUWX
FACTS & FIGURES - 1987		ABCEFGHJ PR
SURVEY OF STUDENTS ATTENDING CITY SITE		ABDEFGHI JKLMNOPQ
CLEP TEST REPORT - ENGLISH & MATH COMPETENCIES		ABCEFGHJ KOPTUX



CODE KEY

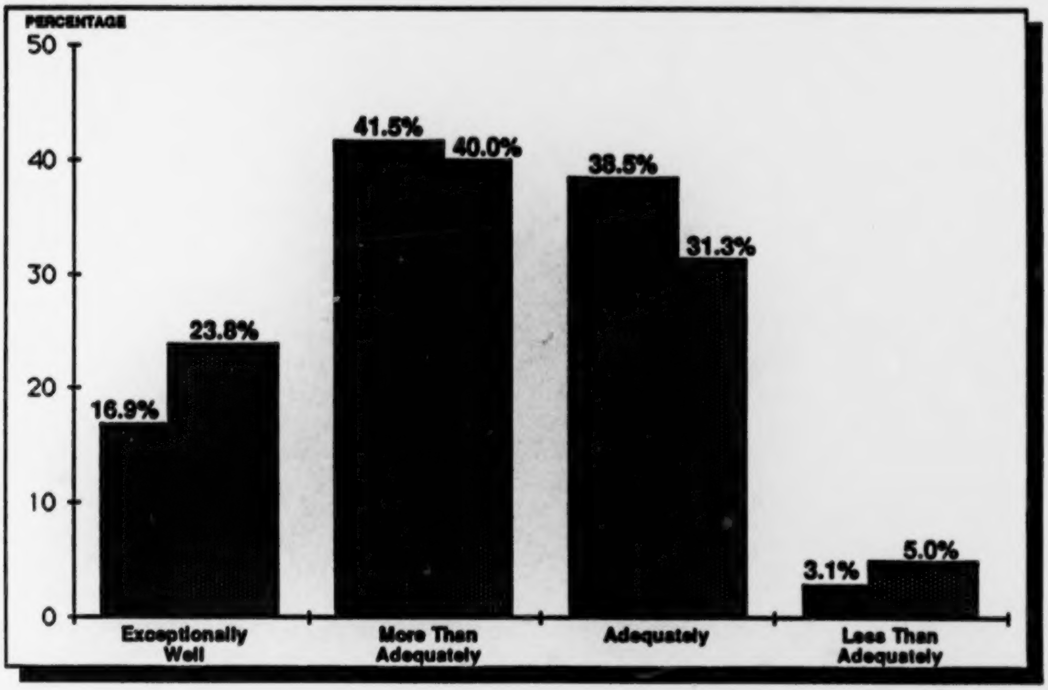
A - Meetings
B - Literature Reviews
C - Telephone/Personal Contacts
D - Instrument Development
E - Compile Data
F - Analyze Data
G - Write Report/Summary/Draft
H - Revisions
I - Pilot Tests
J - Tabulate Data
K - Administer Survey/Test
L - Data Entry
M - Write Computer Program
N - Code/Recode Data
O - Write Letters
P - Develop Graphics
Q - Categorize, List Comments
R - Update Data/Reports
S - Provide Expertise
T - Develop Mailing Lists
U - Clerical Tasks
V - Library Research
W - Solicit Outside Comments
X - Investigate Costs

LEHIGH COUNTY COM

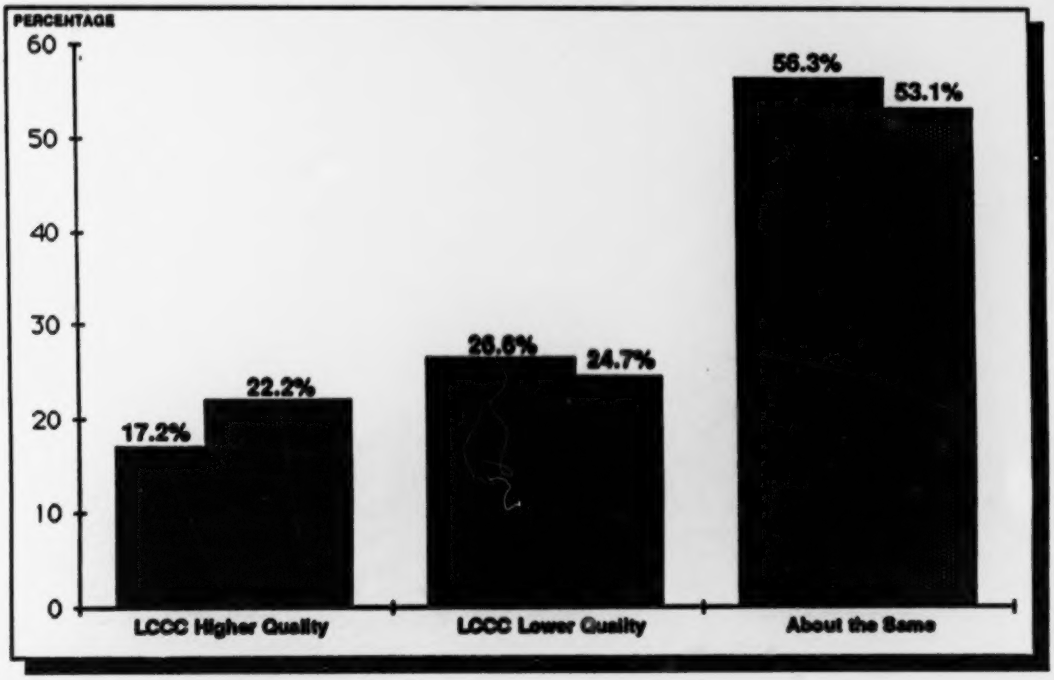
BONNIE L.

Microsoft Chart -- Comparison Of Alumni Survey Responses

How well did your experience at LCCC prepare you overall for your further education?
(This question was answered only by those students who attended another college since being graduated from LCCC.)



Overall, is the quality of teaching at LCCC higher or lower than at other colleges you have attended?
(This question was answered only by those students who attended another college since being graduated from LCCC.)



▇ 1986 Responses ▇ 1985 Responses

A THREE WAY FILE MERGE TO CREATE AN ADMISSIONS/NEW STUDENT SURVEY/PARENT SURVEY DATABASE

Marian Pagano
Institutional Research & Planning
Tufts University

Since 1981 Tufts University has been surveying its undergraduate accepted applicant population to gain insight to the college choice process of high achieving students, and to aid in the development of a marketing strategy. The Accepted Applicant Survey has evolved from a two-page, seven-question instrument to a ten-page, forty-question instrument (see Appendix A).

The survey has always included questions exploring the sources of influence on college choice. Results from these questions have shown that students view parents as having the most influence on college choice. Other studies have also shown parents to play a significant role in the college choice process (Litten & Hall, 1989, Reynolds, 1980, Smith & Bers, 1989). Thus, in order to draw a more complete picture of the college choice process the parents of the 1988 freshmen were surveyed. Rather than view the student's and the parent's views in isolation from each other, these data sets were merged along with the student's admissions record. The plan to merge data allowed the creation of surveys which did not request data students had already provided to the university such as name, social security number, address, test scores, high school, etc. By using personalized mailings clearly coded with the student's social security number a common key existed on all three sets of data.

The resulting file held over 400 variables, a rich ground for exploring the interplay of characteristics as competitive students select an institution of higher learning. The purpose of this paper is to describe the merge experience and to describe one path into this maze of data. Specifically, the importance of a list of college characteristics in students' and parents' perceptions is explored. The merge allows the data to be cut in a variety of ways. The current paper will take a close look at how the importance of college characteristics may vary among different levels of SAT scorers. This demonstrates one way the three-way merge becomes useful and necessary. Literally hundreds of other cuts are possible, exploring these seems only to be limited by time.

It is not believed anyone needs to be convinced a file merge is a useful concept - that point is understood. Rather, it is demonstrated that such a merge transversing computer environments can happen despite a mine field of Murphy's Laws and other assorted glitches.

METHOD

New Student Survey

Matriculating students were mailed the 1988 Tufts University New Student Survey upon receipt of their deposit, normally received in May. The survey (see Appendix A) contains 200 variables including: other colleges applied to and acceptance status, financial aid awards, factors influential in the college decision process, important characteristics of a college, participation in admissions office programs, expectations for undergraduate years and beyond, and some general background questions. Enclosed with the survey was a letter from the Dean of Admissions stressing the importance of the survey, and an addressed return envelope. These data were coded and stored in an SPSSx system file on a DEC10 mainframe.

Admissions Data

Traditional admissions data gathered by the admissions office from students and testing services were also stored on the DEC10 mainframe. The list of variables in this file can be found in Appendix B.

Parent Survey

In November parents were mailed the 1988 Tufts University Parent Survey (see Appendix C). The survey contains 115 variables. Questions on this survey concerned the following: when, if ever, the parents visited campus, how influential they perceived significant people and commercial guides to be on their son's/daughter's college choice, their satisfaction with the admissions and financial aid office, the importance of certain college characteristics and how they rated Tufts on these characteristics, their knowledge and use of sources of information concerning financial aid, their concerns about financing a Tufts education, and finally their thoughts concerning if and how much their son/daughter should work to earn money for college. These data were coded and entered onto an IBM AT compatible using the SPSS/PC+ Data Entry package.

The Merges

The admissions and student survey files were merged on the DEC10 system by the university's computer services department. The 1022 query system was used to extract the relevant admissions data. Next a COBOL program was written using the student's social security number as the key to create a merged ASCII file on the DEC10.

During this time the University was phasing out the DEC10, encouraging users to move to the VAX. The dinosauric DEC10 was lumbering to extinction - it was very unreliable and there was little support for either the hardware or software systems. Access to the system was sporadic and unreliable - the machine created "ghost" errors as it rejected even the simplest SPSS programs with preposterous errors. It was time to move to the VAX.

The ASCII file containing the merged admissions and student survey data was loaded onto a tape and transported to the VAX. The DEC10 was so unreliable at this time that it would be imprudent to depend on a clean transmission of the file using a communications program such as Kermit or Procomm. The ASCII file was loaded onto the VAX and read into SPSSx and a system file was created.

The final phase of the merge was simpler. The parent survey data was stored on an SPSS/PC+ system file on an IBM AT compatible. This file was prepared using the EXPORT command, transported to the VAX using Kermit, read into SPSSx using the IMPORT command, and finally merged with the admissions/student survey file using the MATCH FILES command.

RESULTS

Admissions data were available on all 1196 freshmen. Eighty-seven percent (1060) of the freshmen returned the New Student Survey in time to be included in the merge. Fifty-two percent (617) of the parents returned a survey in time to be used in the final merge. The result was a file of 526 cases containing all three sets of data, approximately 44% of the freshman class.

Influence of Individuals & Groups on College Choice

Students were queried to assess the amount of influence certain persons had on their college choice. Seventy-nine percent of the matriculating students indicated their parents as having a positive influence on their college choice, more than any other person or group. These results are shown in Table 1.

Parents were also asked to assess the amount of influence these persons had on their son's/daughter's college choice. Parents tended to see themselves as the most positive influence on their son's/daughter's college choice. These results are shown in Table 2.

TABLE 1

What effect did the following have on your college choice?

	% Indicating Very Positive or Positive
Your Parents	79%
Student(s) from Tufts	77%
Friends	72%
High School Counselor	62%
Tufts' Admissions Officers	50%
Alumnus/a of Tufts	49%
High School Teacher	42%

TABLE 2

What effect did you perceive the following individuals to have on your son's/daughter's college choice?

	% Indicating Strongly Positive or Positive
Mother	93%
Father	88%
Student(s) from Tufts	74%
Tufts' Admissions Officer	67%
High School Counselor	63%
Alumus/a of Tufts	62%
Friends	62%
High School Teacher	49%

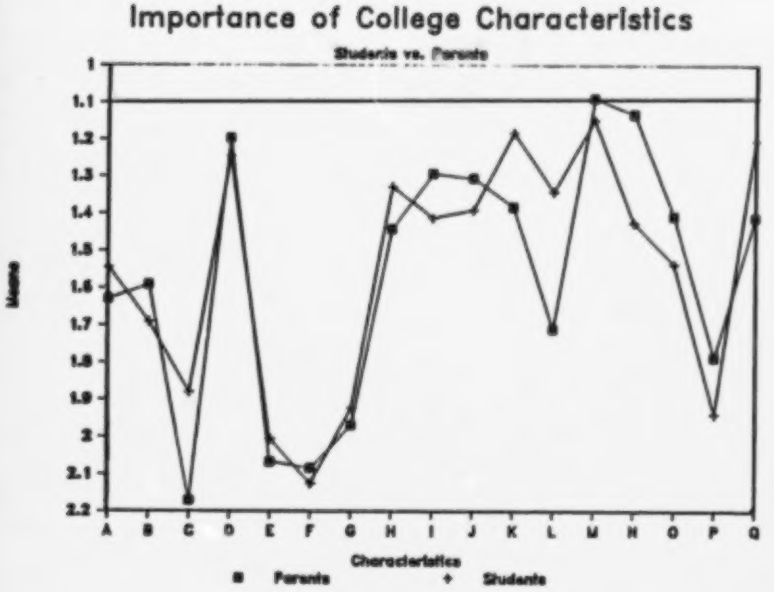
Importance of College Characteristics

For the most part, parents and their sons/daughters had similar ideas on which characteristics of a college were important and which were not. Figure 1 compares the means for both groups on seventeen college characteristics. Parents rated five characteristics higher than the students did, seven characteristics received virtually identical ratings, and students ranked five characteristics higher than the parents did. The largest differences between the two groups appeared when students ranked the characteristic higher than the parents. This was true for the following characteristics: (C) Internship Opportunities, (K) Campus Life, (L) Social Life, and (Q) Location. A large difference also appeared as parents rated (N) Faculty Reputation considerably higher then the students.

Comparisons were made between students who scored high on the SATs (combined 1300 and higher) and their parents (Figure 2). A somewhat looser fit was found between the line describing the parents and the line describing the students, although the general shape of the relationship closely resembled that of the entire population (all students, regardless of SAT score).

Finally, groups of parents and students were compared based on SAT scores, low scorers (combined 1180 and lower) and high scorers (Figures 3 A & B). Low scoring students and their parents were more likely than the high scoring groups to rate a characteristic "very important". The parents of the high scoring group were the most neutral of the four groups, barely rating a characteristic higher than the low scoring parents on (F) Computer Facilities, (O) Cultural Opportunities, and (P) Graduate Programs. Parents of low scoring students found several characteristics noticeably higher than the high scoring parents, those being (D) Faculty-Student Relationships, (H) Employment Opportunities After Graduation, (I) Social Values of the College, and (J) Graduates' Reputation at Professional Schools.

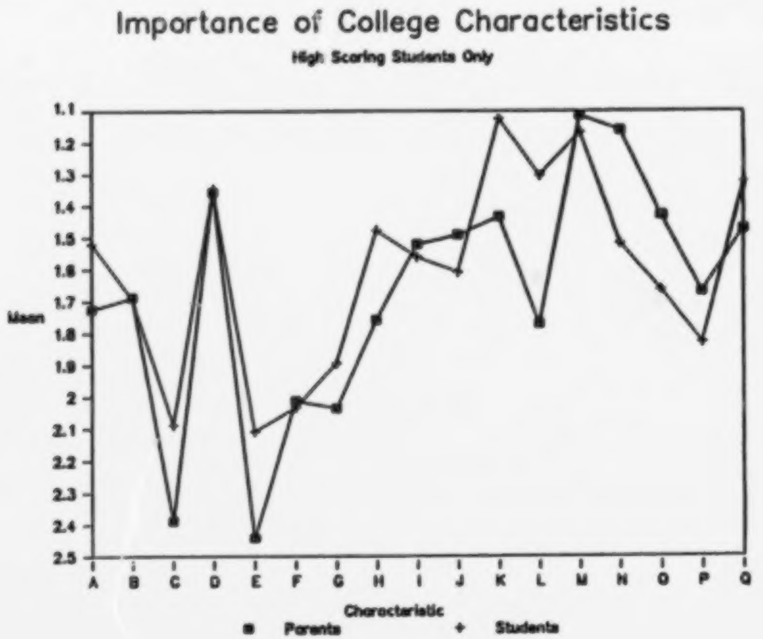
FIGURE 1



CHARACTERISTICS

A – Campus Appearance
B – Housing Quality
C – Internship Opportunities
D – Fac/Stud. Relationships
E – Athletic Facilities
F – Computer Facilities
G – Research Opportunities
H – Employ. Opps. After Grad.
I – Social Values of College
J – Grad. Reputation @ Prof. School
K – Campus Life
L – Social Life
M – Curriculum
N – Faculty Reputation
O – Cultural Opportunities
P – Graduate Programs
Q – Location

FIGURE 2



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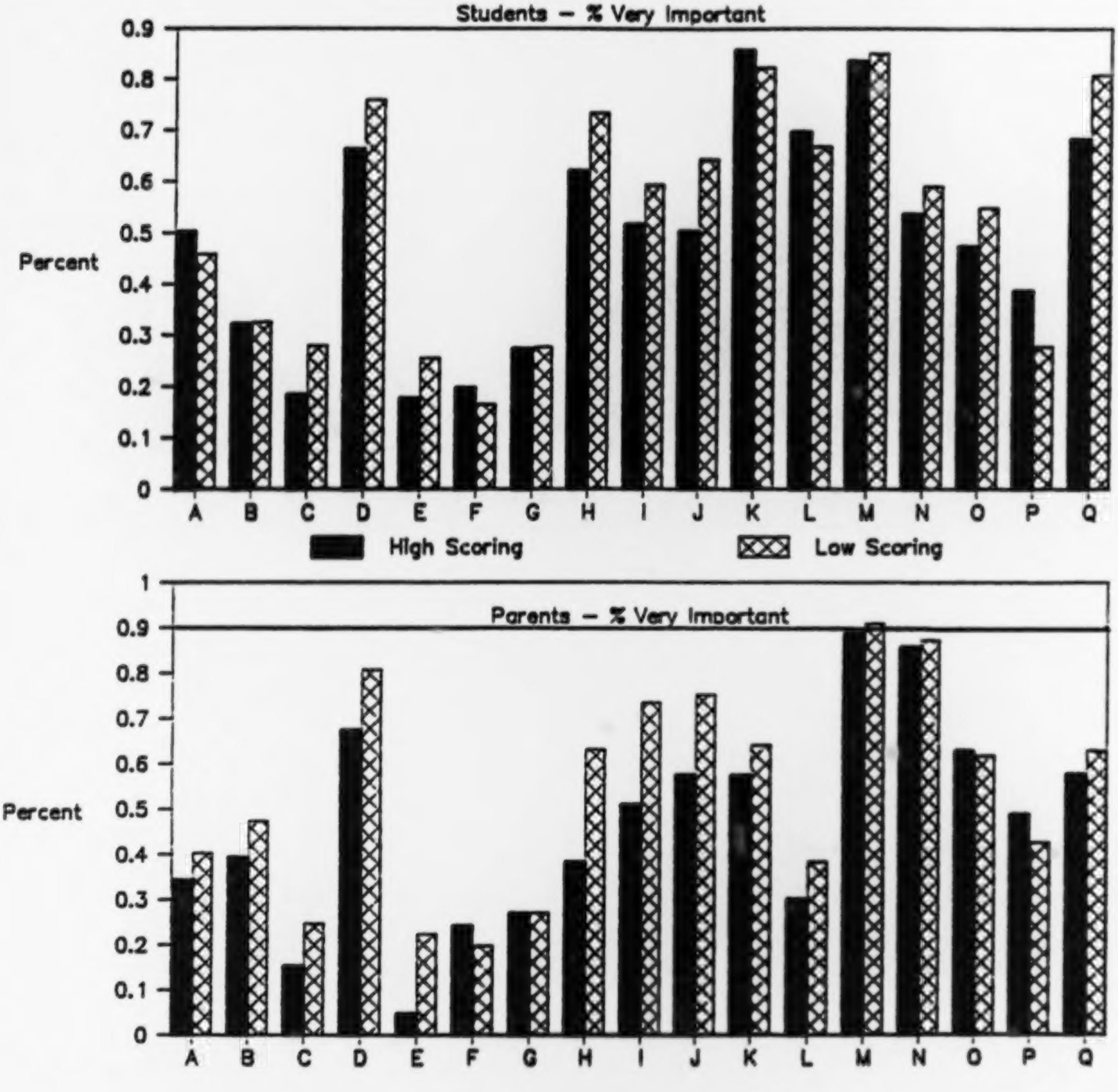
P – Graduate Programs
Q – Location

FIGURES 3A & 3B

Importance of College Characteristics



CHARACTERISTICS

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Low scoring students were more likely to find the following characteristics very important than their high scoring counterparts: (D) Faculty/Student Relationships, (H) Employment Opportunities After Graduation, (I) Social Values of the College, (J) Graduates' Reputation at Professional Schools, (N) Faculty Reputation, (O) Cultural Opportunities, and (Q) Location. High scoring students were marginally more likely to rank (A) Campus Appearance (K) Campus Life, (L) Social Life and (P) Graduate programs as very important. Generally, the differences between the student groups when the high scoring students rated a characteristic "very important" were smaller than when the low scoring students rated a characteristic "very important". Overall, high scoring students and their parents leaned to neutral in rating these characteristics.

DISCUSSION

The preceding results demonstrate one path taken through this immense data file. Following up on the work of Litten & Hall (1989), we were curious to see which characteristics higher achieving students considered most important in making their college choice. SAT scores were used in this example as just one way to qualify a student as high achieving - such a definition would be customized by each institution. The merge created a file we could then manipulate to create and analyze the groups critical to our admissions goals.

It is established by the results from both the students and the parents that parents play a significant role in their son's/daughter's college choice. Therefore, it is not only important what characteristics are important to the student, but what is also important to the parent(s). Once these characteristics are determined the institution can direct its energies and resources to add to or create the characteristics which are desirable to the population it wants to appeal to, or it can redirect its marketing strategy to highlight those characteristics. In addition data, such as presented here, might suggest a different marketing strategy to be used with parents than with students. For example, parents found less importance in a group of characteristics which included social life, campus life and location. Perhaps, then, an institution should be cautious in accentuating such characteristics in its literature to parents. This is general marketing wisdom which becomes more readily available due to the file merge.

No two computing shops are identical. This review could certainly not serve as a guide to a researcher at another institution to achieve a successful merge across environments. It is hoped that this paper does serve as an example of a merge achieved for an institution's own purposes and needs.

There are some suggestions for those who will attempt a merge such as this one. First, plan the merge from the start. This is critical as you create surveys and other assessment instruments. Consider which sources will provide the most reliable data for a variable. For example, in the current study we could have asked students or parents for an SAT score. Clearly the best source was the testing service itself. Secondly, as files are merged together, create a variable which indicates whether or not the piece is present for each case. This will allow easier selecting for those who did provide the additional pieces of data. Next, be sure you have the disk space to move the files around and across environments.

Be aware that merging and matching files takes up much more space than it takes for the data to just live on a disk. Finally, do not rely on the results of a merge if you are on a tight timetable, especially if you are relying on another group or agency to provide data or service for the merge. Murphy's Laws ruled the Tufts merge, taking twice as long to complete as had been planned.

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IMPLEMENTING A PLAN FOR DISTRIBUTED PROCESSING

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Office of Institutional Research and Strategic Planning

Kutztown University

Introduction

The Office of Institutional Research and Strategic Planning at Kutztown University is concluding the second year of a three-year plan to develop the capability for distributed processing within the Office. The ultimate goal of this plan is to develop the capability to download files related to students, personnel, finances and facilities for processing within the Research and Planning Office. Achieving this goal will enable the Research and Planning Office to respond in a timely manner to continually increasing requests for information without relying on the central programming staff. This paper describes the progress to date in carrying out the plan, including the acquisition of necessary hardware and software, and steps taken to produce files for downloading. The Office is carrying out this plan within a data processing environment which is not readily conducive to data communications.

Kutztown University is a comprehensive university within the State System of Higher Education for the Commonwealth of Pennsylvania. The University has enrolled 7,609 students for the Fall 1989 semester, including 6,883 undergraduate and 726 graduate students. The University employs 331 tenure-track faculty and over 700 faculty, administrators and staff. The budget for the University for 1989-90 is over 50 million dollars.

The University carries out the major portion of administrative data processing on a Unisys (formerly Burroughs) A9 mainframe computer. A software system purchased from Triton College and modified by our data processing staff supports admissions, registration, financial aid, advisement, scheduling, student records, and alumni affairs. The Personnel and Payroll Office receives data on all employees from the state payroll office on magnetic tape and loads this information in a personnel data set on the Unisys A9. The University purchased and installed a financial system (CUFS) which runs on a DEC VAX minicomputer to support all accounting functions. Offices have received limited support for automation using word processing and spreadsheet software on Convergent Technology work stations or Burroughs ET2000 intelligent terminals.

Background

The position of Director for Institutional Research and Strategic Planning has existed at Kutztown University since June 1985. Prior to that time, a variety of offices shared responsibility for activities related to institutional research with virtually no data processing support. Upon assuming the position, the Director was charged by the President to develop an ongoing program of institutional research, including assessment, to develop a planning process for the University, and to direct all activities related to Middle States accreditation to take place in 1988. The office support staff consisted of one secretary.

It was clear that, without data processing support from the Computer Center and access to microcomputers and software, the Director would be unable to carry out these responsibilities with the staffing configuration in the Research and Planning Office. Fortunately, the President supported the Office in purchasing an IBM PC-XT in the Fall of 1985 with Lotus 1-2-3, dBase III, Wordstar Professional, and Harvard Project Manager. The Computer Center cooperated in programming basic reports on enrollments, faculty workloads, admissions profiles and personnel information. The development of office automation support with the microcomputer enabled the Director to retrain the secretary to carry out increasingly independent research and support responsibilities, resulting in her promotion to Administrative Assistant. The Office was able to demonstrate increased productivity in responding to requests for information, in carrying out an extensive program of surveys, and in guiding the University through the Middle States accreditation process. This resulted in support for continuing development of data processing capability for the Office.

The Office of Research and Planning currently has an IBM PC-XT and, since the Spring of 1988, an IBM Personal System 2 Model 80 computer. The Office utilizes the following software:

Word processing - Wordstar 2000 Plus
Spreadsheet and graphics - Lotus 1-2-3, Release 3 and Version 2.01
Database management - dBase IV (for the PS2) and dBase III (for the PC-XT)
Project management - Harvard Project Manager 3.0
Communications - Hayes Smartcom
Communications with Unisys A9 - ICC Communications Software
Desktop utilities - Sidekick Plus

Since starting to use microcomputers to support research and other functions, the Director has sought to develop the capability to download files. Although use of the microcomputer has increased productivity, the Office has to enter data manually in order to create files. For example, the Office has maintained a faculty database on dBase IV, with the necessary information entered manually from hard copy reports. The ability to download files directly from the database on the mainframe computer onto the hard disk of the microcomputer would eliminate the tedious manual entry of data with the accompanying chance for errors.

The Office has faced a number of constraints in achieving the capability for downloading files. The storage capacity and memory for the IBM PC-XT, or any PC-DOS compatible microcomputer has precluded the downloading of sizable files. Software for the microcomputer has not been effective in handling large amounts of data. The Unisys (Burroughs) environment has been the most difficult compared to other mainframe environments for communication with PC-DOS compatible microcomputers. Development of the 80386 microchip and ensuing developments in hardware and software have begun to remove these constraints.

The Plan

With the development of computers utilizing the 386 processor and with the pending development of OS2 and DOS 4.0 operating systems which enable the microcomputer to access more memory and storage capacity, the Director began in the fall of 1987 to develop a plan for a major upgrade in the computing capability in the Research and Planning Office. The plan included the following sequence of activities:

1. Purchase an IBM Personal System 2 Model 80 computer;
2. Purchase communications software to enable the IBM PS2 computer to communicate with the Unisys A9 mainframe computer;
3. Download a personnel file from the mainframe computer to the PS2 computer;
4. Replace the IBM PC-XT with an IBM PS2 Model 55 computer;
5. Upgrade to DOS 4.0 to take advantage of memory and storage capability;
6. Purchase OS2 operating system software; and
7. Expand memory and storage capacity of PS2 Model 80 microcomputer.

The Director chose the IBM PS2 Model 80 computer as the primary hardware upgrade for the following reasons:

* multi channel architecture

* potential for large volume of sales and resulting attraction for third party software development

* processing speed

* memory and storage capacity

In the spring of 1988, the Office installed the IBM PS2 Model 80 microcomputer. The computer has 1.9 megabytes of memory and a 314 megabyte hard disk. The Office installed ICC communications software and a TDI converter to permit communications between the PS2 computer and the Unisys A9 mainframe computer. In the spring of 1989, the Office downloaded a personnel file from the personnel data set in the mainframe computer to the PS2 microcomputer and converted it to a dBase IV file.

Downloading of the Personnel File

The Director worked in concert with systems and operations staff from the Computer Center in carrying out the initial steps for downloading the personnel file. The Director first reviewed the "DASDL," the description of the database on the Unisys A9, to determine which fields in the personnel data set would be downloaded for each record. The fields were as follows:

social security number
employment status (FT or PT)
name
sex
ethnic status
date of birth
type of employee
type of bargaining unit
department
title
salary range and step
date of hire
degree earned
tenure status
tenure date
salary

The staff of the Computer Center wrote a program to identify the fields for each record to be downloaded and print the fields to an ASCII file under the Research and Planning account number.

File Express, software included in the ICC communications software package for terminal emulation, enabled the Director to download files from the Unisys mainframe. The Director first activated the terminal emulation program which enabled the microcomputer to emulate a Unisys terminal. He then activated the File Express software housed in the Unisys mainframe, returned the microcomputer to the MS DOS environment, and activated the File Express software on the microcomputer. Figure 1 shows the initial menu for File Express:

```
             > > > > >   I C C / F i l e X p r e s s   < < < < <
   Copyright 1987 Intercomputer Communications Corp., Version 2.00.0.1.2

             F1      Upload (transfer a file from micro to host)
             F2      Download (transfer a file from host to micro)

             F3      Transmit/Receive a message
             F4      Dial phone/modem
             F5      Hang up phone/modem

             F6      Execute/start a transfer definition
             F7      Create/edit a transfer definition
             F8      Enable Host-Initiated File Transfers
             F9      Exit ICC/FileXpress
             F10     Exit ICC/FileXpress (sign off host program)

        >>>  Choose by pressing the appropriate Function key  <<<

 ************************  Current Status  **************************


                                  IDLE
```

Figure 1. The main menu for File Express.

The main menu presents a choice for immediate downloading of a file (F2), or preparing a batch file for later downloading of a large file

(F7). The batch program permits setting a specific time for downloading so that an office can download a large file in off-peak hours to avoid tying up communications for other terminals.

Choosing to immediately download a file results in a menu as shown in Figure 2. The Host filename specifies the specific file to be downloaded from the mainframe under the office account number. The Micro filename specifies the drive\directory\file name to receive the downloaded file. Currently, the 314 megabyte hard disk drive in the PS2 Model 80 is configured under DOS 3.3 into 11 logical drives of 30 megabytes each. The personnel file was downloaded to logical drive "D." The Director chose the remaining specifications in consultation with the Computer Center staff. The "No" responses to "Compress spaces to tabs?" and to "Strip trailing spaces?" were critical in creating fixed length fields for later transfer to dBase IV.

```
                >>>>>   ICC/FileXpress   <<<<<
                  Download (transfer file from mainframe to micro)

  Host filename:__________________________________________________

  Micro filename:_________________________________________________

          Overwrite file on micro if it exists?            Yes
          Append newline sequence to each record?          Yes
          Add CtrlZ character as EndOfFile?                No
          Compress spaces to tabs?                         No
          Strip trailing spaces?                           No
          Blank sequence numbers from host?                No
          Datacomm address                                 A1
          BackGround transfer?                             Yes

1Execute                                                      10MainMenu
```

Figure 2. Menu for specifying file downloading.

Initial problems in downloading the personnel file resulted from a lack of familiarity with communicating from the Unisys mainframe to the IBM PS2 microcomputer. The Computer Center staff was used to downloading address files for use on the Convergent Technology word processing software in the "CTOS" operating system environment. The field delimiters used for this type of downloading did not work with dBase IV in the MS DOS environment. After some trial and error, the Director used a comma as delimiter, with quotation marks around alpha fields. The Director used the dBase command, "APPEND FROM (FILENAME) DELIMITED" to append records from the ASCII file into a dBase file constructed according to the field specifications.

Downloading the personnel file permitted the Research and Planning Office to carry out several studies without having to request programs from the Computer Center. Included were the following:

1. Average faculty salaries by sex, by rank and by department;
2. Distribution of faculty by ethnic status and by department;
3. Number of faculty by department to reach the age of 65 by year.

The ease of translation between dBase IV and Lotus 1-2-3 permitted the use of both software packages in carrying out these analyses.

Downloading Student Data Files

During the spring and summer of 1989, the Director of Research and Planning worked with the Computer Center staff to identify fields in the student datasets for downloading in the Fall 1989 semester. The Director selected fields from the datasets for undergraduate admissions, graduate admissions, and enrolled students. Members of the Administrative Data Processing Users' Group assisted in selecting fields related to their areas. The Director targeted the census date for "freezing the database" and reporting enrollment as the date for downloading files.

The admissions file included the following fields for each record:

student number
sex
ethnic status
home county
state
country
enrollment status
term of admission
action (accept, reject)
entering status
housing status
high school class size
high school class rank
high school county
year of high school graduation
type of diploma
predicted QPA
highest verbal SAT score
highest math SAT score
activities interest
admissions condition

The downloaded file contained over 7,000 records for all persons applying for undergraduate admissions. The database file took approximately 800,000 bytes of disk space.

The enrolled student data file contained the following fields:

student number
name
county
date of birth
sex
citizen status
ethnic status
marital status
first term of enrollment
last term of enrollment
credits earned
credits attempted
grade point average
veteran status

major and minor	developmental study status
probation status	residence status
academic warning status	current credits

The downloaded file included all students enrolled and cleared for the Fall 1989 semester, 7,609 records taking approximately 1 million bytes of disk storage.

The Office of Research and Planning is just beginning to take advantage of the ability to analyze the student data. DBase IV permits the linking of different database files to create a "view." Using the student number as a link, the Director combined fields related to admissions characteristics with fields in the student enrollment data set to analyze characteristics of first-time students. The Director computed the median verbal, math and combined SAT scores by major. An analysis of characteristics of first-time students scoring below 300 in the verbal SAT is in progress.

Miscellaneous Uses of Downloaded Files

The Office of Research and Planning has used the capability for downloading files as part of two studies. In order to respond to a short-term request by the State System central office for comparative admissions data for first-time students in 1985 and 1988, the Director used downloaded files with the necessary data. The Director downloaded the student numbers and names of registered first-time students and appended them into a dBase IV database file in which will be entered the responses to a survey of entering students. This will permit future analyses of these responses as factors related to grade point averages, retention and other information---all linked by the student number.

Potential Areas of Concern

The increased capability to download files for use by individual offices raises several areas of concern which institutional research officers, computer center directors, and, ultimately, policy makers must address. Who should maintain ownership of the data? Who determines what is considered official data? Who establishes and monitors the timing of downloading from a dynamic, ever-changing database? What are the implications for security---limiting access to sensitive areas of information regarding students and personnel. With the decentralizing of information processing, who ensures that proper documentation of reports will be maintained?

The distribution of information processing capability will permit broader access and could result in improved planning and decision making. However, it could also result in a "Tower of Babel" with conflicting information from many sources. University policy makers should identify specific offices which will release official University reports. For example, all enrollment reports should agree with census enrollment figures unless identified as based on different data. The institutional research officer, working with the information processing officer, can play a key role in recommending policies and procedures to policy makers. This will ensure consistency in the timing and format of reports.

The institutional research officer and the computer center director should work together to ensure proper security and documentation of reports. At Kutztown University, the Computer Center Staff controls the content and account number for the ASCII file to be downloaded. The Director of Research and Planning can download only files under his account. Each office with responsibility for producing reports should also have responsibility for preparing documentation for those reports. Without documentation, an office could lose consistency in reporting, particularly with turnover of personnel.

Future Possibilities

The Office of Research and Planning at Kutztown University has only begun to tap the potential for distributed processing. Continuing development of this capability will depend primarily on software development. The Director continues to monitor this development, particularly within the OS2 environment. At present, the Office of Research and Planning continues to utilize ongoing enrollment reports generated from the mainframe computer. Eventually, reports generated by the Research and Planning Office could replace these reports. The Director will work with the Computer Center Staff to identify other files for downloading, including those related to faculty workload and facilities. The financial software package operating within the DEC environment includes software for downloading files. The Director will seek to utilize this software as well.

The capability for distributed processing represents a major advance for the Office of Research and Planning in terms of productivity and flexibility. The Office is now much more self-reliant in responding to requests for information. Producing reports which in the past required program requests taking months now take days or hours to produce. The Director is definitely becoming more popular with the Computer Center Staff! The future for institutional research as it relates to technology is as exciting as it has ever been.

THE PREDICTION OF COLLEGE SUCCESS: THE METHODOLOGY OF A PRAGMATIST

ZANDRA S. GOLDBERG GRATZ, Ph.D.

The state university of New York, college of Technology at Farmingdale, is a two year technical enrolling over 10,000 full and part time students per year. This paper presents a work in progress; the genesis of which was the recommendation of a college wide committee studying retention. The recommendation, to build a profile or pathway by which a student decides to become either a retention or attrition statistic, requires access and merging of data maintained in several different offices across campus. This paper describes the initial study, the access of different data sets and the initial stages of analysis.

The Study of Retention

A broad based enrollment management committee, chaired by the director of institutional research, was charged the task of defining, measuring and making recommendations as to ways to improve retention. Although we spent what seemed an inordinate amount of time defining retention, the definitions we developed served as the questions against which we accessed information from our college data base.

In so doing, we examined patterns in one and two semester attrition over the past five years of freshmen. These data were examined by college, academic school and curriculum. The data we accessed yields information which includes the following:

- The number if students who changed curriculums and their subsequent retention;
- GPA alone is not a sufficient indicator of student success. Students with high GPA's may not have earned many credits; course withdrawal confounds the statistic;
- As reflected in national figures, about one third of our students take more than four semesters to complete a degree; and
- It allowed us to establish baseline indicators of retention, against which efforts to improve retention can be compared.

To add to this information, we surveyed all faculty and staff, a current student sample as well as a sample of students who had recently left the college after one or two semesters of study. Those who left after one or two semesters were surveyed via twenty minute phone interviews. Not only did the literature review we conducted help to govern the development of the surveys, but the information gleaned from the college database helped to shape the surveys.

Information acquired though the surveys was broad. We acquired information relative to the ultimate question of the study: "Why Students Left?" The most popular reasons included that their intent was to take only a few courses, money problems, preference for work over school and to transfer to a four year program. Information developed from the study included:

- Although students may take more than four semesters to complete their degree, a substantial portion of the faculty still believe in the two year associate degree;
- Faculty believe student use of their office hours would be of value but few students take advantage of this resource;
- We were able to learn not only what students liked and disliked but to what extent different aspects of the college contributed to their decision to leave college. That is,

although very few indicated they were satisfied with registration, no one indicated registration contributed to their decision to leave college. Faculty teaching skills, on the average, were highly rated. However in instances where they were not, former students indicated faculty teaching skills contributed to their decision to leave the college; and

- Identified the frequency with which different services were used as well as their perceived value.

The study yielded a series of recommendations, based on the information generated. These ranged from taking an active role to retention to the utilization of specific programs and services, such as the establishment of a freshman experience. A recommendation falling under the heading of "Taking an Active Role with Regard to Retention" was the recommendation that an attempt be made to identify those students likely to become attrition statistics so that we may target them for suitable interventions.

The description of the retention study is intentionally limited. It is reported here as the background against which data from various offices at the college was accessed and merged. Individuals interested in a more complete description of the retention study are referred to the author for copies.

Data Access

The question to be researched is, "can we identify, with some degree of accuracy, which students are likely to leave the college prematurely". To this end, and using, only standard database software, the following data sets were acquired and merged via student ID number:

- First is the information accumulated by the admissions office. Normally, the application, which includes a high school transcript, remains in paper format. Over the summer, a college work study student entered nearly 100 bits of data for over 1700 fee paid applicants into a database. This includes such items as regents scores, SAT information and high school rank.
- The next set of data to be accessed was the freshmen survey. Through the office of institutional research, a freshmen survey is administered to all new students. Although the original impetus for the survey was enrollment management, it now requests of the student information such as their goals at Farmingdale, their goals within higher education and among other items, why they chose Farmingdale. In view of the impending task, last year was the first year we asked students to record their name and ID number. For nearly all of our entering freshmen these data reside in a dbase file.
- The next set of data accessed were the results of placement exams in the basic skills area. These tests are administered to all new students by the learning center; who also maintains students' scores on a file.
- The last set to be accessed required programming skills and the assistance of our computer center. From the college data base, data such as GPA, credits attempted, students program and students last semester of attendance are but a few of the elements extracted and merged with the file.

Using this database, which is an aggregation of data from several offices, the development of a profile or pathway toward retention or attrition is currently in progress. It is likely that in the years a head, this data set will be merged to that collected by our career and placement office. In addition, this database could be merged to other data sets such as those maintained by our counseling center, financial aide of residence life. The extent to which this occurs will depend on the questions asked.

The Prediction of Attrition

Retention is a complex issue, the profile must consider academic skills, work habits, goals, motivation, and personal support systems. Rather then wait for the development of a student tracking systems which would coordinate data entry and retrieval into an interactive database, the use of standard PC software facilitated the formation of an extensive database from which complex analyses can be performed. At present, a series of zero order correlation coefficients have been calculated between attrition, the decision to leave after one semester or retention, the reason to continue college studies for more than one semester and the myriad of variable available. Those which have proven significant at the p<.01 level include, but its not limited to the following:

- Goal at Farmingdale - those indicating they want to earn an associate degree are more likely to continue.
- Transfer Interest - those indicating they plan to transfer after Farmingdale are less likely to continue.
- College Placement Scores - The poorer the math and language arts skills the less likely the student continued.

These results are preliminary. The combination which best predicts the decision to stay or leave at Farmingdale will be extrapolated after additional semesters of information are accessed. That is, students will be considered "retained" if they remain on campus for more than two semesters and make reasonable progress through their program (currently only one semesters worth of data are available); the combination of variables which best predicts retention will then be used to target students as well as develop a model by which suitable interventions may be exercised.

BIRTH PANGS OF AN ENROLLMENT PLAN

Ann A. Weeks, Ed.D.

INTRODUCTION AND PERSPECTIVES

In the spring of 1985, a large eastern University directed each of its campuses to set up Enrollment Management Task Forces to "discover and implement more intensive and effective recruitment practices." Each team was to include senior officers and heads of departments involved in recruitment and enrollment processes, e.g., admissions, academic affairs, budget, bursar, college relations, EOP, financial aid, registrar, and student development.

To comply with the University's directive, Island College created an Enrollment Management team in the fall of 1985. Establishment of this team also addressed a previously articulated College priority of "coordinating resources, policies, and procedures for the recruitment, registration, and retention of students." In the spring of 1988, a new President reaffirmed the College's commitment to enrollment management by establishing a new Enrollment Planning Committee composed of the following members:

Assistant to the President for Institutional Research
  and Planning, Chair
Vice President of Academic Affairs
Vice President of Student Affairs
Dean of Faculty
Director of Institutional Research
Director of Admissions
Registrar
Director of Public Relations
Two faculty members from the Admissions Committee

On March 11, 1988, the President called the first meeting of the committee and presented some of her enrollment concerns. She requested that the committee meet to discuss these and other enrollment issues.

LITERATURE REVIEW

According to Mabry (1987), enrollment management is the process of defining enrollment goals and establishing procedures to reach these goals. It can include clarification of institutional mission, long-range planning, academic program planning, marketing, recruitment, retention, and career planning and placement.

Muston (1985) has stated that, "The primary purpose of enrollment management and marketing strategies in higher education is to assure a systematic and deliberate effort to make realistic adjustments in plans and programs consistent with the institution's purpose and mission. The integrity of institutional purpose and mission is paramount and should not be sacrificed by hastily develped strategies or activities added in time of crisis."

In Pollack's (1987) opinion, colleges should consider goals and objectives, institutional environment, structures, needed staff skills, and research and evaluation when establishing an enrollment management program. He sees enrollment management as a holistic concept which stresses a campus-wide approach. In so doing, it addresses issues of recruiting and retention while viewing the student as a "whole" person.

Pascarella (1986) reports that a most salient influence on persistence and degree completion is the extent of person-environment fit. Other research has shown that the characteristics which initially attract students to a university are very similar to those characteristics that motivate them to stay.

Tinto (1976, p.125) showed that the higher the degree of integration of individuals into college systems, the greater will be their commitment to the specific institution and the goal of college completion. Astin (1976) found that the less the student is involved in the academic experience, the less learning will occur and the greater the chance that the student will become dissatisfied and drop out.

Hossler (1984, p.144) emphasized that an effective plan for managing enrollments must encompass a wide-ranging set of activities. For him, the enrollment management process should begin with a strategic plan that outlines the desired characteristics of the student body.

One of Keller's (1983) seven steps in enrollment management is the development of an overall enrollment managment master plan that includes goals, strategies, and specific actions regarding:

a. marketing and recruitment
b. pricing and financial aid
c. institutional research
d. public relations and publications
e. career planning and placement
f. academic assistance programs
g. retention, and
h. alumnae.

METHOD/APPROACH

On May 23, the President of Island College presented the following charge to the Enrollment Planning Committee and requested that the Committee develop an Enrollment Plan by the fall of 1988:

> "The Enrollment Planning committee at Island College has been established to serve as an advisory body to the President in matters pertaining to enrollment. Enrollment planning encompasses the coordination of all activities related to the recruitment of students, the maintenance of enrollments, and the successful achievement of students in fulfilling their academic objectives.
>
> "The Enrollment Planning Committee is charged with developing an overall enrollment master plan for the next two to three years which should include goals, strategies, and specific actions. Particular goals that should be addressed are:
>
> * Increased enrollments:
>   - Full-time, part-time
>   - Residents, commuters
>   - First-time-to-college, transfers
>   - Evening, returning students
>   - Up-state, out-of state
>   - High school teachers
> * Increased retention
> * Graduate programs
> * Feeder high schools
> * Increased ethnic diversity
>   - Commuter students
>   - Residential students
> * Expanded summer activities
>   - Island students attending college elsewhere
>   - Summer sessions accessible to high school students
>   - Non-credit activities (e.g., Kids College, sports camps, senior citizens)
> * Courses for business and industry
> * January, weekend courses (e.g., language immersion)
> * Incorporation of academic programs into the enrollment plan
> * Earlier enrollment of students."

During the first three months that the Enrollment Planning Committee met, membership was gradually increased. To tap expertise in business and marketing, two professors from these departments were added to the committee. To broaden campus representation of faculty, ethnic/cultural groups, and non-traditional students, the chair of the faculty council and other faculty members were added.

At the first few meetings, discussions ranged far and wide over enrollment issues. Among the items discussed were: college strengths, possible marketing actions, environmental matters, and institutional research reports. Concerns were raised pertaining to residence halls, study conditions, race relations, adjunct faculty, sexual harassment, evening student services, prior negative publicity, lack of resources, student violence, feeder high schools, late enrollments, dorm security, College credibility, and the impact of 350 additional students.

The wide-ranging discussions at meetings were often marred by hidden agendas, administrative-faculty antagonisms, turfism, and denial of problems. One administrator attacked the Dean of Instruction for not making certain that faculty fulfilled their professional obligations. Another administrator refused to discuss with faculty the problems in an area that reported to her. Faculty members worried that increased enrollments would mean larger class sizes with no new faculty lines. Administrators became defensive when faculty members with expertise in their areas offered variations on the status quo. Faculty were apprehensive that some suggestions meant quality would be sacrificed. They stressed the importance of preserving quality as a prime consideration in all enrollment management efforts. A sense of frustration with long-standing problems created an undercurrent of hostility in the group as committee members unconsciously sought scapegoats.

To cope with the committee's negativeness and lack of direction, the faculty chair suggested that a combination of brain-storming and nominal group techniques be employed. Rules were established whereby each person around the table was asked to present a positive suggestion to accomplish the President's enrollment goals. Regardless of feasibility, these suggestions were to be accepted without criticism and written on the chalkboard. At later meetings the suggestions would be sorted for feasibility, priority, time sequence, specific activities and/or financial considerations. This approach worked well keeping suggestions positive and digressions minimal. The only problem (a relatively happy one) was the amount of time involved because creative committee members had abundant ideas.

Despite problems with decreased attendance due to vacations, the committee worked throughout the summer. By the end of July, the brainstorming of strategies had been completed. By the end of August strategies had been culled for feasibility, grouped, and divided into short-term and long-term objectives. The only problems encountered concerned members who were lax in submitting assignments.

RESULTS/FINDINGS

Any of many different frameworks could have been chosen as a backbone for the Enrollment Plan. The framework actually selected was that identified by Ray Muston in his 1985 book, Marketing and Enrollment Management in State Universities (p.26-27.) Muston has performed extensive research and work in the field of enrollment management, especially as it relates to public higher education. His framework consists of the following twelve traditional, specialized functions which have an integrated role in a comprehensive enrollment management system.

1. Admissions
2. Public Relations/Publications
3. Student Retention
4. Counseling
5. Faculty Departments
6. Alumni Affairs
7. Placement
8. Housing/Residence Halls
9. Financial Aid
10. Institutional Research
11. Development
12. Orientation/Registration

Each of the twelve sections contained from one to several objectives. Every objective was divided into three sections: a statement of the objective; a short section on rationale; and a final section containing the recommendations. This format made the study easy to read and provided background information that justified the recommendations. At one time, the committee had planned to separate short-term from longer term objectives. Later, however, it decided to incorporate only objectives that could be accomplished within two years. Objectives that would take longer were to await direction from the College's long-range plan.

After objectives accepted from the brainstorming sessions were placed in one of the twelve groupings, they were organized into the outline and adapted into a coherent draft by a single writer to make the document read smoothly. The draft was then presented to the committee for its concluding suggestions. These were incorporated into the final Enrollment Plan which was submitted to the President in December.

The President accepted the plan and presented it to the faculty at the beginning of the spring semester. She charged the Enrollment Committee with overseeing its implementation. A year later, committee members were requested to submit written reports concerning their areas detailing which recommendations had been initiated, which recommendations could be accomplished with present resources, and which would need further resources.

IMPLICATIONS/CONCLUSIONS

It can be seen from the preceding descriptions that many actions which occurred during the development of the Enrollment Plan were productive while others should have been modified. In order to help others develop an Enrollment Plan more efficiently, the following recommendations gleaned from the above experiences are offered.

1. Secure public support of the President for Enrollment Management.
2. Obtain a written charge from the President to the committee before it meets.
3. Assure that the enrollment committee has as members:
    a. administrators who represent areas concerned with enrollment management,
    b. students,
    c. representatives of the budget office and/or bursar,
    d. faculty who represent various constituencies, and
    e. faculty with expertise pertinent to the project.
4. Begin with the College mission. Examine it and tie goals to it.
5. Link the enrollment plan to college planning, curriculum, budget, and the research base wherever possible.
6. Prepare, organize, and plan actions carefully before meetings.
7. Open meetings on a positive note. Require that suggestions be phrased positively.
8. Prohibit negative comments, personal attacks, defensive comments. Address hostility.
9. Use brainstorming techniques when creating "something from nothing."
10. Keep minutes of each meeting. Send memos regarding meeting announcements, assignments, and deadlines.
11. Be firm, confident, enthusiastic.
12. Close meetings on a note of positive accomplishment. Summarize.
13. Institute methods for implementation and evaluation.
14. Make certain authority and resources accompany responsibility for implementation and evaluation.
15. Choose perfection in the written report over meeting a deadline if such a choice is necessary.
16. Be patient if the time is not ripe for acceptance of a good idea. Once stated, it has already begun to work.
17. Choose an outline for the final plan as soon as possible to give an orientation and direction to discussions.
18. Have one person compose the final version of the Enrollment Plan so that it presents a coherent, smooth-reading document.

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ENSURING RESULTS FROM THE INFORMATION SYSTEMS TECHNOLOGY: FIVE INSTITUTIONAL RESEARCH SCENARIOS

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The significance of information to a higher education institution is a topic of little debate. An almost insatiable appetite for data among administrators and external agencies has become an accepted phenomena. This appetite is increasingly supported by a proliferation of what some term management information systems. On many campuses, institutional research or planning offices are but one office charged with the responsibility of converting the data produced by these systems into usable information for planning. Information production about the institution has emerged as a major activity on campuses and about campuses. Available and proposed technology, at its most basic level, simply adds to the amount of information production possible.

Understanding the potential impacts of new management information systems requires some degree of awareness of the technology and the factors likely to influence the eventual use, disuse or misuse of information produced through these new management information systems. This paper explores these topics and develops five different potential scenarios that can accrue from adoption of the new systems.

THE TECHNOLOGY OF MANAGEMENT INFORMATION SYSTEMS

Much has been written in the literature of higher education administration about information systems technologies. The history of administrative computing was well summarized by Ryland (1988) who described it as follows:

> By the early 1970's, most of the larger higher education institutions were immersed in systems development and were wrestling with issues of data-base management and the transition from punch card batch processing to on-line systems. As technology advanced, mainframe system capabilities grew exponentially in terms of processing power and data storage capacity. (Ryland, 1988, p. 27)

As she further explains,

> the earliest administrative applications were developed in a disjointed fashion with data files tied closely to the programs for each individual application. Problems with data inconsistency and redundancy argued for an integrated data base approach. (Ryland, 1988, p. 29)

Companies currently compete to deliver software and hardware that enable administrators access to the information they deem necessary for decision-making. While such software and hardware is often advertised as a management information system, conflicting definitions of that term abounds. As Emery (1987) presented, support exists for several points of view: that a

> MIS deals only with the management- or decision-oriented parts of an information system; (that) the MIS involves only the transaction processing part of the system; (and that) the MIS combines both decision making and transaction processing components. (Emery, 1987, p. 22)

In this paper, management information systems are defined as the software and hardware that make possible access of a data base and collection of data from separate files to produce information in the desired format for the leadership at a particular institution.

Historically, the greatest drawback to such systems in higher education has been the separate files in which data are stored. On many campuses, data about admissions, student registration and enrollment histories, financial aid, testing results, alumni, and facilities are stored in ways that make interaction between these various files difficult, if not impossible. An even more substantial difficulty emerges in connecting these data files with those that support accounting, purchasing, budgeting, personnel and payroll functions. This particular problem is becoming a less significant difficulty on many campuses as new systems are implemented that provide access to more of the previously segregated data files.

Moving to these new systems is not an easy task as many institutions would probably be willing to attest. Some of the issues confronting a team charged with that responsibility include those presented by Mayhew (1983) such as: departmental involvement, gradual implementation, costs and upper-level administrative support. In the process of adopting new management information systems, whether campus-developed or package-purchased, those responsible must examine which of the data files are most important for access. To be able to identify those data files requires an understanding of the uses of such data once produced. If that kind of communication between data-processing, institutional research, planning, top-level administrators and systems developers can occur, the likelihood is greater that the information needs of the institution can be better defined and served.

The subjects of management information systems, data production, conversion of data to information, and especially information use are not generalizable to all higher education institutions. On individual campuses, the production and use of information varies. With a new management information system, five distinct scenarios become possible. These scenarios are not as concerned with the use of the system itself as with the use of the data or information the system makes possible.

THE FIRST SCENARIO:
MORE DATA RESULTS IN MORE USEFUL INFORMATION

The first scenario is the most obvious--it concludes that with more kinds of data available and more uses for the data, increased use of the information to support college and university planning will occur. When an institution adds a new management information system, potential analyses may become limited only by the persons responsible for producing and analyzing planning data.

Most institutions currently collect certain common kinds of data. Some of the information produced to support college and university planning relates to the internal workings of the institution. For example, such disparate tasks as faculty workload analysis and student course-taking behavior analyses are regularly undertaken at most institutions.

Such information is used for a variety of purposes again common to most campuses. Collected information, properly employed, can be used to shape marketing and retention programs, inform budgeting decisions, support alumni giving and development efforts, benefit facilities planning, improve human resource management and assist curriculum planning.

With enhanced information production capabilities, it seems obvious then that the different kinds of data available will increase and, in turn, the potential uses of that information will also multiply. In addition, it can be argued that an increase in the constituencies such as external agencies examining and using the data is likely given the new ease of acquiring desired information.

THE SECOND SCENARIO:
MORE DATA DOES NOT NECESSARILY MEAN MORE USE

The second scenario holds that the use of information is far more complex than simply increased information production capabilities. An increase in available data for analysis will not necessarily result in more information for use. Some authors in the field contend that the already existent obstacles to use of information on a campus will simply be more pervasive.

Several versions of this second scenario can be developed. The first is that the new management information systems, even if they do come to reflect users' needs rather than the convenience of programmers or perceived needs of a few offices, may not alter organizational functioning. If campus leadership perceives that the technology simply expands the capabilities of data-processing rather than actually produces necessary information, little change will occur in the use of the information to support campus planning efforts. In other words, if the new management information system is viewed as a means of processing data rather than producing information, it will not be effective in keeping management informed.

The second version of this scenario has less to do with the perceptions of the systems than with what happens to the newly available data once produced. If those responsible for presenting the new information use ineffective presentation forms, the use of that information will be diminished. Kinnick (1985), for example, proposed that researchers must tailor their presentations if information is to actually be used.

The final version of the second scenario is also tied to the persons responsible for converting the newly available data into information. Often overlooked are these offices which are important determinants of what information is produced and used. Planning and institutional research offices have no universally accepted role definitions. On some campuses, their role is primarily data production; on others, it is data analysis; on some, it is even data maintenance in addition to production and analysis. Such offices are sometimes included in determining both the kinds of systems that should exist and the kinds of information that should be produced from the available data. Their involvement can be important to ensuring that the new management information system truly informs management. Their lack of involvement in that process can diminish the likelihood that the information production made possible with the new system will actually have any organizational planning utility.

With a new management information system in place, the role of the institutional research or planning office can become cumbersome. An increasing centralization of the information production function may occur. Previously inaccessible data to the office may now be available for study and information production. Because of improving technologies, the speed of acquiring desired information has been exponentially increased. With a more significant role, however, can come expectation for and dependence upon increased performance. Planning or institutional research offices with the ability to produce considerable data are often asked to produce even more data. If additional resources or, in some cases, personnel are not forthcoming to support those efforts, more information, despite the potential to produce it, will not be made available.

THE THIRD SCENARIO:
MORE DATA MAY MEAN LESS USE OR EVEN MISUSE

Although many are quick to see the advantages of new management information systems, some can quickly point out potential disadvantages. As more data becomes available, a planning or institutional research office may have difficulty in identifying the most important of the newly available data. Two situations are possible: given insufficient resources, the office may, in its quest to produce useful information to decision-makers, may actually produce less useful information if the wrong choices are made among the data. Even if the resources are prevalent, too much information may be produced creating a situation of overload for the decision-maker so that campus leaders actually use less relevant information to make crucial decisions. If the task of choosing among the available information becomes too cumbersome to the decision-maker, less information may actually be used in the decision-making process.

Misuse of information is a difficult argument to make since its definition is subject to the interpretation of the person making the allegation. However, most planners or institutional researchers can identify what they would define as inappropriate conclusions drawn from given data--either because other information was not studied or because contradictory information was studied but its instructions dismissed. This possibility increases when the new management information systems are linked with a second new technology, micro-computers and their capacity to serve as a means of studying large databases. Some like Hawkins (1988) have argued that the micro-computer has democratized resources and enabled individuals and departments "to use technology in a manner that allows a new-found degree of independence from traditional computing structures." (Hawkins, 1988, p. 13) Such independence can have negative side effects, however. Controlling the damage made possible when departments are able to produce "local" data and do so without appropriate quality control can be difficult. As Ryland explains, downloading of institutional data bases to the ubiquitous micro-computer is a trend that will continue to increase as

> increased band widths permit the faster downloading of larger data-base segments. With new and more powerful processing chips, microcomputers have already been found to provide faster processing in a dedicated mode for some computer intensive jobs than mini-computers or even mainframes in a time-shared mode. (Ryland, 1988, p. 31)

The potential ramifications of the combination of these two new technologies should not be dismissed lightly. The issues of who is converting the data into information and the perspectives they bring to their examination of available data are significant ones. The process of interpretation of the data can be political. Fincher (1983) has perhaps stated it best:

> Information is perhaps always political in its implications. Organization, analysis, and interpretation must be for some purpose, but once data become information through organization and analysis, the information is subject to more than one interpretation. (Fincher, 1983, p. 13)

His example, while humorous, clarifies this point:

> Student grades are indicative of data that are collected and stored for fairly specific purposes, but they are seldom analyzed and reported on any basis other than the individual's transcript, for fear of the many, and presumably erroneous, interpretations that can be made. There is a distinct possibility that, given a choice, many college instructors would have their bank accounts published instead of their grade distributions. (Fincher, 1983, p. 13)

Distributed information production, then at its very least, increases the potential for multiple interpretations of available data and even deliberate ignorance of significant data for decision-making.

THE FOURTH SCENARIO:
MORE DATA BUT STILL NOT ENOUGH DATA

A fourth scenario would be that increased information production simply results in an increased awareness on the part of campus leaders about the other kinds of information they need and have not been able to study. Such information may not be database-accessible. For example, a term that came into vogue in the 1980's, "environmental scanning," refers to an institution's process of sifting through available information about its environment to make projections for the future. Environmental scanning can include but is not limited to demographic analyses of a particular locale or state. Such information will not be obtained through an institution's management information system. However, the increased availability of information on internal operations may make the need for more information on the external environment more noticeable.

THE FIFTH SCENARIO:
INCREASED SYMBOLIC RATHER THAN SUBSTANTIVE USE OF DATA

There is one final scenario that could be construed, that more information will be produced but that it will serve a different purpose than that which might be expected. Two organizational theorists, Feldman and March (1981) have argued that organizations actually suffer from a condition of information-overload. They contend that more information is requested and collected than is used; that information collected often has no decision relevance; and that information is on occasion collected after the decision has been made. While their descriptions are made of organizations in general, the statements do have special applicability to higher education--an environment which has great respect for the acquisition of knowledge. Feldman and March propose that collection of information, even unused information, serves two vital purposes. Collection of information and the appearance of its use, in their view, serves as a signal to others of individual competence and as a symbol of a legitimate decision-making process.

The symbolic value associated with information production and use does have implications for defining the potential impacts of new management information systems in higher education administration. This fifth scenario of increased symbolic use of information is attractive because it rings true. People do use information as a symbol of their rational decision-making processes. Higher education administrators may be among the best examples of such people. If enhanced information production did not symbolize some perceived positive attribute, why else would universities invest such large sums of money in new "administrative information systems?" Planners certainly have their share of requests for information even when they know the decision for which the information is purportedly being collected has already been made. A new information system will make rapid retrieval of even more data possible, increasing the appearance of rational decision making behavior among top leadership. While the behavior may be substantially more rational, the prospect that it may also be symbolically, rather than substantially, more rational should not be ignored.

PREDICTING THE LIKELY SCENARIO

Five scenarios have now been developed: (1) that increased use of the information will occur; (2) that already existent obstacles to use of information on a campus will simply be more pervasive; (3) that either less use or misuse of data will result; (4) that the increased production of information from the new information system will result in an awareness among campus leaders of the other kinds of information needed; and (5) that the new information produced will serve a symbolic purposes as much as a substantive purpose.

As a new system moves to implementation on campus, it is often greeted with the same mixed reactions as any other change--some perceiving it as a panacea for all organizational problems and others wary and mistrustful of its potential implications. Initially, people talk about what the "new system will be able to do" in tones that border on worship. Old systems seems to pale in comparison to all the perceived benefits of the new system. Many individuals can cite operational improvements (e.g., improved advising) likely to result from adoption of a new information system. Fewer individuals initially recognize that new information systems also make possible increased information production about the institution. For example, some new systems allow the creation of a new field not existent before on a student database to indicate whether a student is an on-campus or off-campus resident. These systems permit retention studies not only comparing on-campus and off-campus residents but residents by life-style (e.g., coeducational or single sex) or by individual residence halls. Such information can be used to shape decisions about student services.

Enhanced information production does not automatically convert into increased information use as four of the five scenarios indicate. Several factors can be identified that will influence which of the scenarios is most likely to develop. These include: the "data-mindedness" of the campus leadership and their decision-making style; the skills and resources available to the office responsible for converting the newly available data into information; and the potential for distributed administrative computing.

RECOGNIZING THE DATA-MINDEDNESS OF CAMPUS LEADERSHIP

At some institutions, the leadership is extremely "data-minded" and also conversant about information technology and appreciate the nuances of data collection as well as information presentation. Such leaders may make clear their intention to use the new management information system to every conceivable advantage as a support for planning purposes. Knowing the patterns of uses of prior provided planning information among campus administrators makes such prediction easier. In those cases, it is fairly clear that the first scenario is more likely than the other four.

The "data-mindedness" of campus leaders can often be associated with a particular decision-making style. Some campus administrators are believers in the rational decision-making process. Chaffee (1983) defined rational decision-making in higher education as a process of evaluating alternative courses of action and making a deliberate choice among alternatives based on collected evidence that one alternative is superior to the others. The rational decision-making style clearly would be far more dependent on the information systems technology than those who follow one of the other four models Chaffee presented in her volume: the collegial, political, bureaucratic or anarchial styles.

One should keep in mind, however, that for some campus leaders, concern about the appearance of a particular decision-making style may be more real than actual use of that style. Most planners or institutional researchers can identify leaders who seem more concerned with the appearance of using data to support decisions rather than actual use of that data. In those cases, the final scenario becomes most likely.

If the decision-making style of campus leadership can be best identified as political rather than rational or collegial, a different scenario becomes more likely. Either those in possession of the information will use it for their own purposes--thus fulfilling the first predicted scenario of increased use of the information or they will restrict access to certain information to only allies--thus creating the second scenario of more data but less use.

Data-mindedness can have another potential effect. When top leadership is extremely data-minded, control of available data may be a primary concern to them. In those cases, directors and department chairs may find hands-on access to institutional data limited. This may occur even if physical capability for distributed computing is possible. In those cases, the likelihood of the third scenario of increased misuse (as it might be defined by these top administrators) is reduced.

"Data-driven" leaders will also be quicker to move to the fourth scenario than leaders less concerned with data. As more data becomes available to such leaders, it is unlikely that their appetite will be satisfied. Instead, the reverse is likely to occur. Provided more information on the internal happenings of the institution, such leaders are likely to seek increased information on the causes of those happenings, data sometimes accessible from the new management information system and sometimes not.

Leaders less data-driven may move to the second scenario. If too many obstacles exist to their use of the newly available data, e.g., its presented form or their own perception that available data has limited utility, leaders will be less likely to use the data. Similarly, if campus leaders perceive the new system to improve data processing rather than to enhance information production, they will be less likely to take advantage of the newly available information.

REVIEWING ONE'S AVAILABLE RESOURCES

In determining which of the five scenarios is most likely to develop on a given campus, the resources and skills of the office responsible for conversion of the newly available data into information should not be ignored. If plentiful resources and the inclination to use the data are present, the first scenario is likely.

Many planning and institutional research offices, however, are not abundantly staffed or provided other resources. Choices then must be made between analyses rivaling for attention. If the wrong choices are made, the second scenario of more data but not necessarily more use may result. If sufficient resources are made available to produce the data but not to present it in its best form, the second scenario is also most likely.

Staffing and available resources can also impact whether or not the fourth scenario develops. If campus leaders recognize that the planning or institutional research office is not amply or appropriately staffed to explore the additional questions arising from initial consideration of the data, such questions may remain unasked and, in turn, unanswered.

DETERMINING THE POTENTIAL FOR DISTRIBUTED COMPUTING

Depending upon the technological literacy of those on a campus and the availability of desk-top computers, the potential exists for distributed administrative computing. If the desk-top computers are prevalent and the technological literacy is high, distributed administrative computing becomes more likely. One other factor can determine if distributed administrative computing is likely on a given campus. Campus leadership may want to continue to control the data and, if so, the likelihood of distributed computing is greatly diminished.

Some would argue that with distributed computing, the first scenario of more information production and use will occur. Others could argue that distributed computing can make the third scenario of potential misuse of the data a contending prospect. With distributed computing, multiple interpretations of the data become more likely. Some might perceive such multiple interpretations as misuse of the available data. And, just as with centralized administrative computing, distributed computing can support the fifth scenario, an increased symbolic rather than substantive use of the data.

BEYOND PREDICTION: CREATING A GIVEN SCENARIO

Stopping at identifying the scenario most likely to develop on one's campus given its leadership and resources available for planning would be short-sighted. By recognizing what characteristics are likely to lead to which scenario, planners and institutional researchers can take measures to develop a desired scenario. If the first scenario is desirable, planners and institutional researchers must ensure that the obstacles to use of the information made possible through the new system are overcome and that their campus leaders even if not data-driven can be educated into seeing the merits of using information, both in substantive and symbolic terms, to support planning efforts.

Planners and institutional researchers then must not merely be able to predict a given scenario from adoption of a new information system but must also remain cognizant at all times on their own potential impact to produce a certain scenario either through action or inaction. Taking appropriate action could mean the difference between symbolic and substantive use of produced information or, even more significantly, between great use, little use and no use of the available planning information.

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THE STRUCTURE AND FUNCTIONS OF INSTITUTIONAL RESEARCH OFFICES WITHIN NEAIR

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INTRODUCTION & CONCEPTUAL FRAMEWORK

This paper reports the results of a 1989 survey of all NEAIR member institutions. We collected information about the staff size, educational preparation, and years of experience of those carrying out research and analysis functions, usually under the label of "institutional research", but often under other related rubrics. We also requested information about the location of Institutional Research (IR) in the campus organizational structure. Finally, we asked respondents to indicate the degree to which various types of internal analyses, external reporting activities, and special studies are centralized in IR at each campus. The research examines the extent to which these responses about IR tasks are related to professional variables (such as level of training and years of experience), as distinct from organizational variables (such as campus size and hierarchical location of the IR function.)

We are interested in the extent to which Institutional Research is evolving as a profession. The professional and organizational literature suggests that higher levels of professionalism are attained by higher levels of education and experience (Etzioni, Hall). The more that institutional research offices are staffed by full-time professionals, who earn advanced degrees, and remain in their careers for a good many years, the greater the claim that we can make for I.R. as a distinct profession. More importantly, years of experience and levels of education are assumed to have a bearing on the nature of the tasks performed. Higher levels of training and experience should be associated with higher level tasks.

Organizational structures and the people who occupy them place both demands and constraints on the labor performed by the workers. Thus, the work of an institutional research office is influenced by its location in the organizational structure, as well as by the expertise of its staff. The literature contains several conceptual frameworks which are useful to our understanding of IR functions. A systems view sees organizations composed of a variety of subsystems which interact with each other and with the organization's environment. For example, **Katz & Kahn** (1978) describe a managerial or executive subsystem headed by the President or Chancellor, the production subsystem (in higher education this is academic affairs which produces teaching and research), the maintenance/support subsystem (consisting of accounting, budgeting, payroll, housing, dining, personnel, buildings and grounds, and similar support services), adaptive subsystems (for example, planning, analysis, and environmental scanning), and boundary subsystems (such as admissions and public relations).

A second useful framework is described by **Mintzberg** (1983) who identifies five basic parts of all organizations:

The Strategic Apex (similar to Katz & Kahn's managerial subsystem)
The Operating Core (similar to Katz & Kahn's production subsystem)
The Middle Line (consisting of Vice Presidents, Deans, and heads of large divisions)
The Support Staff (similar to Katz & Kahn's support subsystem)
The Technostructure (similar to Katz & Kahn's adaptive subsystem)

We would expect an IR Office housed in one subsystem or organizational part to behave differently from one housed in another.

METHODOLOGY

Using the NEAIR mailing list, we sent surveys to about 200 member institutions in April 1989 and received responses from 141 campuses. Nineteen of these campuses have no formal organizational structure called institutional research (or its equivalent) and no professional staff person with a related job title. These 19 institutions are excluded from the analysis.

We collected information about the size and type of each institution, based on student enrollment and Carnegie Classification. The survey asked respondents to indicate the organizational location of IR and the title of the person to whom the office reported. Respondents were encouraged to sketch or send an organization chart and many did. The Questionnaire also asked respondents to indicate the staffing patterns in their offices. For the professional staff we requested the highest degree, academic field, and years of experience for each person. We then listed over three dozen functional tasks and sought respondents on a six point scale:

Not Applicable	Centralized		Decentralized		
to this Institution	In Inst. Research	In one other Office	Shared by two offices Incl. I.R.	Excl. I.R.	Dispersed Among 3+ Off.
1	2	3	4	5	6

TABLE 1

DESCRIPTION OF STAFF IN INSTITUTIONAL RESEARCH OFFICES

(N = 265)

HIGHEST DEGREE

Doctorate:	33%
Masters:	46%

ACADEMIC FIELD OF HIGHEST DEGREE

Social Science:	39%
Education:	26%
Math & Science:	14%
Business:	11%
Humanities:	8%

YEARS OF EXPERIENCE IN INSTITUTIONAL RESEARCH

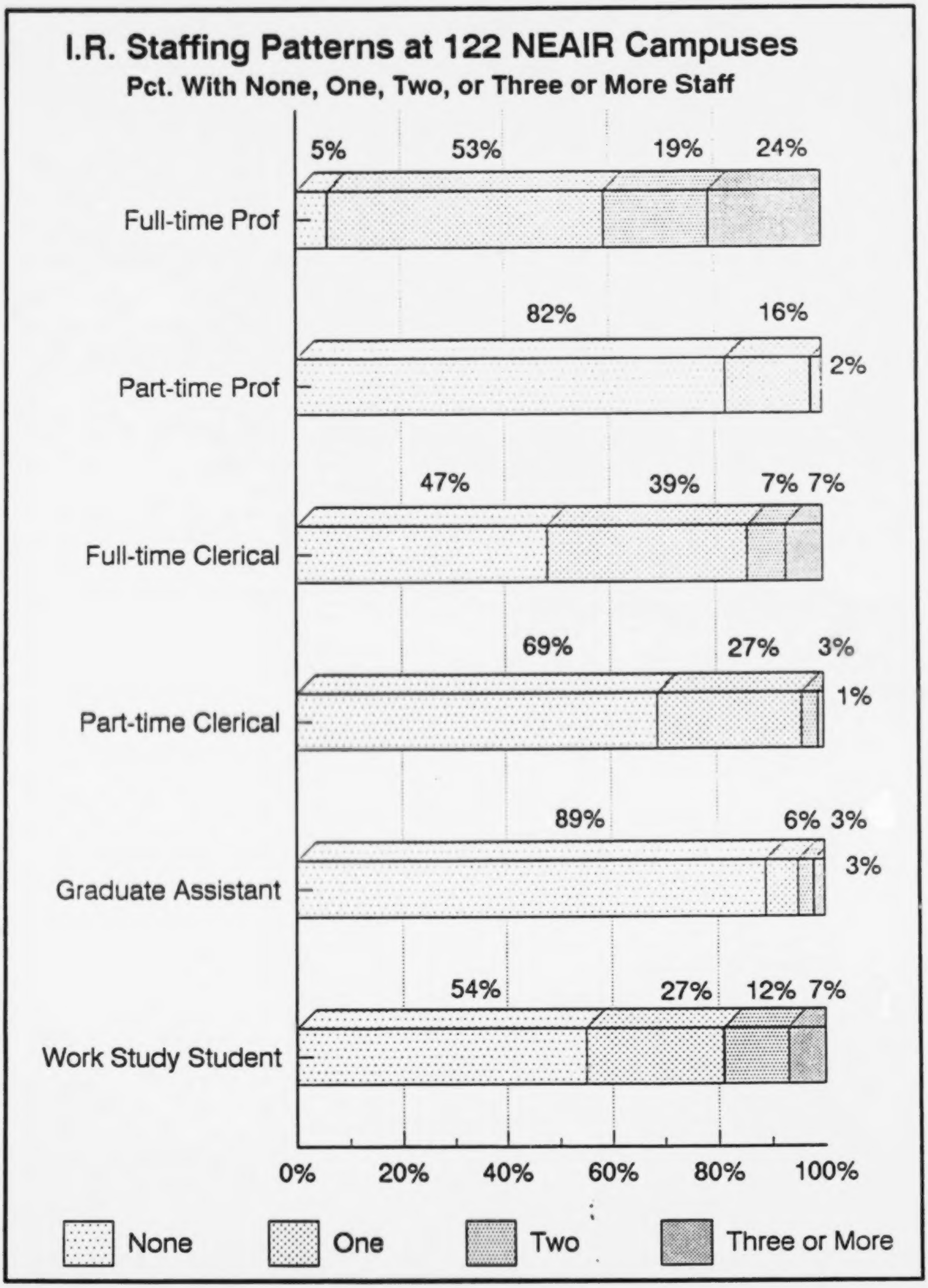
0-2	27%
3-5	27%
6-10	21%
11+	25%

TABLE 2

ORGANIZATIONAL LOCATIONS OF INSTITUTIONAL RESEARCH OFFICES SIZE BY ADMINISTRATIVE LEVEL & BY ADMINISTRATIVE AREA

	Administrative Level			Administrative Division		
SIZE (FTE Stu)	Pres./Chan.	VP/VC	Below VP/VC	Pres./Chan.	Acad. Affs.	Others
Under 1200	10	6	1	10	4	3
1200 to 2499	10	7	5	15	3	4
1500 to 4999	6	13	13	12	13	7
5000 to 9999	10	14	7	14	7	10
10,000+	2	14	4	5	8	7
TOTALS (N = 122)	38	54	30	56	35	31

3



I.R. Staffing Patterns at 122 NEAIR Campuses

Pct. With None, One, Two, or Three or More Staff

PROFESSIONAL VARIABLES

The first table shows the profile of the 265 full-time professional staff in the 122 institutions with useable responses. About 79% hold at least a masters degree, but only one in three have completed the doctorate. IR professionals received their most recent degree in one of the fields listed: 39% in the Social Sciences and 26% in Education. Math & Science (including Engineering and Computer Science) accounted for 14%, and Business fields 11%. Regarding their years of experience, about one fourth of the professionals are veterans of over ten years while another one fourth are relative newcomers.

The bar chart shows the staffing patterns within the 122 IR offices we analyzed. 53% of these offices have only one full-time professional and 3 out of 4 have two or less professionals. 5% of the campuses have an IR organizational unit with only part-time staff, and less than one in four have three or more professionals. A majority of respondents report having no part-time clerical, graduate assistant, or work study personnel.

ORGANIZATIONAL VARIABLES

Table 2 shows the administrative location of IR offices by campus size. Administrative level refers to whom the Director (or equivalent title) reports. At smaller campuses the IR office tends to report to the Chief Executive. As institutions increase in size, IR Directors are more likely to report to a Vice President or Vice Chancellor or Provost. Interestingly, colleges with enrollments between 1500 and 5000 are most likely to place IR at organizational levels below Vice President. 21 of the 30 campuses which place IR at the lower administrative levels are comprehensive colleges (10) or two year institutions (11).

Administrative Division refers to the functional location of Institutional Research within the organizational structure. IR most often (56 campuses) is lodged within the executive division, especially in smaller colleges. The second most common pattern (35 campuses) places IR within the production subsystem, academic affairs. The remaining campuses distribute IR among the various support and technical subsystems including business and finance, planning, and student affairs.

TABLE 3

CORRELATIONS AMONG THE ORGANIZATIONAL AND PROFESSIONAL VARIABLES USED IN THE STUDY (N = 122)

	PROFESSIONAL VARIABLES		
	Staff Size	Years Experience	Highest Degree
ORGANIZATIONAL VARIABLES			
Campus Size	.73	.37	.40
Carnegie Classification	.60	.38	.35
Functional Location of Institutional Research	.22	ns	ns
Level of Institutional Research in Hierarchy	ns	ns	ns

TABLE 4

CORRELATIONS BETWEEN THE TASK HIERARCHY AND THE PROFESSIONAL AND ORGANIZATIONAL VARIABLES EXAMINED IN THE STUDY

	Correlation with Task Hierarchy
Professional Staff Size	.45***
Years of Experience	.31***
Highest Degree Earned	.25**
FTE Enrollment	.27**
Carnegie Classification	.22*
Administrative Location:Level	-.01
Administrative Location:Function	02

Based on the literature, we expected to find larger, more professionally trained staffs in larger, more diverse educational organizations. To some extent this is true. As shown in Table 3, IR staff size is highly correlated with campus size (.73) and the Carnegie Classification (.60). These in turn are significantly correlated with years of experience and highest degree. However, we found little significant correlation between the professional variables and the location of IR within the organization.

TASK VARIABLES

Table 4 lists in descending order the three dozen tasks we asked respondents to rate. The first column shows the percent of campuses which centralize these functions in Institutional Research. The second column shows the percent of tasks shared between Institutional Research and one other office.

More than 75% of IR Offices play a significant role in the first dozen tasks. Ranking especially high are attrition/retention studies, enrollment reporting, reporting student characteristics, responding to surveys and external requests for data, and producing factbook information. On the other end of the scale, institutional researchers are seldom, or only peripherally involved in preparing campus budget requests, producing research and resource development statistics, projecting revenue, reviewing academic programs, collecting student ratings of instruction, and developing databases and information systems.

We were especially interested in the nature of special studies conducted by IR offices. The fifth table shows the number of campuses reporting IR involvement in all of the special studies we listed and the ones added by respondents. The respondents indicated a high degree of involvement in studies related to student attrition, retention, academic performance, enrollment management, outcomes assessment, and supporting studies for accreditation. Student opinion surveys and alumni studies also were frequently listed.

TASKS BY FUNCTION

As a next step, we identified the tasks which most closely support the Campus-wide executive function, the academic affairs function (production of teaching and research), the business and finance function, among others. Since the vast majority of Institutional Research offices (75%) are housed within the President's and Academic Affairs Divisions, we gave particular attention to the tasks judged to be most congruent with those two functions. We found partial support for our hypothesis but not as great as expected.

TABLE 5

MOST FREQUENT TASKS CARRIED OUT BY NEAIR MEMBER INSTITUTIONS
(N = 122)

	Percent Campus Responses		
	Centralized in Inst. Res.	Shared	Total
Attrition/Retention/Graduation Studies	66	27	93
Reporting Enrollment Data	52	34	86
Reporting Other Student Characteristics (e.g., race, gender, geographic origins)	57	29	86
Supplying National Survey Data	67	18	85
Granting Requests for Data Exchange	71	11	82
Admissions/Enrollment Mgmt. Studies	27	55	82
College Guidebook Surveys	58	23	81
State-related Requests for data	60	21	81
Enrollment Projections	47	33	80
Producing Campus Factbook	66	11	77
Faculty Workload Analyses	49	27	76
Degrees Awarded Statistics	49	27	76
Studies of Stu. Acad. Performance	37	32	69
Research on campus-wide issues	48	20	68
Student Opinion Surveys	45	23	68
Environmental Scanning	43	24	67
Salary Studies	33	31	64
Generating Personnel Statistics	12	48	60
Alumni Studies	29	31	60
Reporting Admiss. Qual. Indicators	16	42	58

TABLE 5 (continued)

MOST FREQUENT TASKS CARRIED OUT BY NEAIR MEMBER INSTITUTIONS

	Percent Campus Responses		
	Centralized in Inst. Res.	Shared	Total
Assessment of Educational Outcomes:			49
Measurement of General Educ. & Intellect. Growth	10	21	31
Measurement of Personal/Social/ Non-cognitive Stu. Growth	11	18	29
Measurement of Achievement in the Academic Major	8	18	26
Measurement of Stu. Basic Skills	4	18	22
Accreditation Related Studies	21	27	48
Preparing the Campus Planning Document	26	22	48
Economic Impact Studies	27	20	47
Budget/Cost/Resource Alloc. Anal.	9	35	44
Affirmat. Action Compliance Data	15	28	43
Space Alloc. Stats./Anal.	15	26	41
Academic Program Reviews	6	27	33
Revenue Projections	4	28	32
Stats. on Stu. Ratings of Instruct.	20	9	29
Research Funding Trends	9	16	25
Resource Development Stats.	3	13	16
Prepar. Campus Budget Request	3	12	15
Development of Databases and Info. Systems	6	6	12

TABLE 6

SPECIAL INITIATIVES AND STUDIES REPORTED BY NEAIR MEMBER INSTITUTIONS (N = 122)

Type of Initiatives & Studies	No. Campuses
Attrition/Retention	112
*Admissions/Enrollment Mgmt.	99
Stu. Acad. Performance	84
Stu. Opinion Surveys	83
*Alumni Studies	71
*Assessment of Educational Outcomes	60
*Accreditation Related Studies	58
*Acad. Program Reviews	40
Misc. Academic Issues	31
Misc. Finance/Budget Issues	27
Misc. Campus Issues (e.g. Childcare)	29
Misc. Stu. Affairs Issues	19
*Info. Syst./Technol./Computing	14

*In the majority of cases, these initiatives were reportedly conducted in partnership with at least one other office.

10

Those in the Organizational APEX or executive subsystem report slightly more IR involvement in executive/campus-wide tasks. Those in the other administrative divisions report more frequent responsibility for tasks in their task areas, such as Academic Affairs, Business & Finance, Planning, etc.

HIERARCHY OF TASKS

As a part of our analysis, we made judgements about the difficulty and complexity of each of the tasks on the questionnaire and the others added by respondents. For example, the degree of training and expertise required to report enrollment numbers was judged to be at a lower level than making enrollment projections. And these are each exceeded on the task hierarchy by conducting enrollment management studies. Similar judgements were made about the other listed tasks which were grouped into high, medium and low categories. In general, special studies, assessment, survey research and other IR work requiring expertise in research methods and statistics were judged to be at the highest of the three levels. At the lowest end of the hierarcy were some of the traditional IR activities such as responding to surveys, producing a factbook, and reporting student characteristics.

Based on the Organizational and Professional literature, we expected to find that this Task Hierarchy would be related both to the organizational and to the professonal variables. Are larger IR offices and more highly trained and experienced staffs more likely to carryout higher level responsibilities?

The results are shown in Table 4. The Task Hierarchy is most significantly correlated with the size of the professional staff, followed by the years of experience, highest degree, and campus size. The functional location of IR and its level in the hierarchy are unrelated to the Task Hierarchy. The results support our expectation that more complex tasks are conducted by larger staffs which score higher on the professional variables (such as level of training and years of experience). As expected, the correlations with institutional size and Carnegie Classification also are significant, in part due to their correlations with the professional variables shown in Table 3. But the organizational variables (especially the hierarchical location) appear to have less influence on the difficulty and complexity of tasks carried out by IR offices, than do the professional variables.

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TABLE 7

TOP TWENTY-FIVE NEAIR OFFICES ACCORDING TO TASK HIERARCHY

INSTITUTION	TASK HIERARCHY RANK	FULL-TIME IR PROFESSIONAL STAFF
Univ. of Delaware	1	7
SUNY-Albany	2	4
SUNY-Stony Brook	3	6
West Virginia U.	3	6
Dundalk Comm. Coll.	3	1
SUNY-Buffalo	6	5
SUC-Geneseo	6	1
Boston Univ.	8	16
Georgetown U.	9	4
Univ. of Connecticut	9	7
Schenectady Comm. Coll.	11	1
Univ. of Rochester	12	6
Bryant College	13	2
Montgomery Comm. Coll.	13	1
Carnegie Mellon	15	3
Empire State Coll.	16	3
Prince George's Comm. Coll.	17	2
Lehigh Comm. Coll.	18	1
SUC-Oswego	19	1
Coll. of A & T at Delhi	19	1
Rockland Comm. Coll.	21	2
Univ. of Vermont	22	4
Essex Comm. Coll.	22	2
Bloomsburg Univ.	24	3
SUC-Environ. Sci. & Forestry	24	1

TABLE 8

NEAIR OFFICES WITH THREE OR MORE PROFESSIONAL STAFF

INSTITUTION	FTE ENROLLMENT (000)	PROFESSIONAL STAFF SIZE	DEGREES & EXPERIENCE RANK	TASK HIERARCHY RANK
Boston U.	21.7	16*	18	16
U. Pittsburgh	27.0	15**	15	30
Cornell Univ.	17.0	8	12	33
U. Delaware	15.5	7	3	1
U. Connecticut	19.9	7	1	9
Penn St. U.	30.0	7	7	96
U. Rochester	14.3	6***	11	12
SUNY Stony Brook	15.7	6	37	3
West Virginia U.	7.9	6	28	3
SUNY Buffalo	24.0	5	30	6
SUNY Binghamton	11.3	5	13	51
Rutgers	39.0	5	16	51
U. Mass.-Amherst	23.3	5	14	87
SUNY Albany	13.6	4	9	2
Georgetown	10.3	4	4	9
U. Vermont	9.4	4	7	22
Mercer County C.C.	4.8	4	67	27
Ithaca College	5.9	4	23	30
Concordia U.	17.0	4	77	33
U. New Hampshire	10.6	4	30	36
U. Mass., Boston	8.6	4	35	46
Temple Univ.	25.3	4	67	48
Tufts Univ.	7.6	4	9	109
Carnegie Mellon U.	6.2	3	47	15
Empire State Coll.	4.2	3	6	16
Bloomsburg U.	6.1	3	23	24
SUC Plattsburgh	5.3	3	38	46
U. Rhode Island	12.0	3	84	53
American Univ.	9.2	3	2	94

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* = includes both the Office of Analytic Studies (9), and the Office of Enrollment Planning (7).

** = includes 5 computer systems staff and 2 policy staff.

*** = includes both the Office of Enrollment Research (3), and the Office of Financial Planning & Institutional Studies (3).

However, an institution's score on the Task Hierarchy is not as predictable from its characteristics as we expected. For example, Table 7 lists the top 25 (out of 122) institutions on the Task Hierarchy, headed by the University of Delaware. Some of these 25 have well-staffed IR Offices, but at least half do not. Evidently, a large number of one and two person offices are carrying out enrollment management analyses, assessment, and other kinds of special studies, just like the larger offices.

Another perspective is shown in Table 8, which shows the 29 campuses with 3 or more IR professional staff. First of all, there are no small institutions on the list (only two under 5000, for example, and none under 4000). Second, 25 of 29 rank in the top half of the population based on their years of experience and advanced degrees held (led by Connecticut, American, Delaware, and Georgetown). Third, all but four of these 29 rank in the top half of the Task Hierarchy.

DISCUSSION

These finding are generally consistent with our expectations and the organizational literature. Larger IR offices are generally found at larger institutions ranking higher on the Carnegie Classification. These larger IR offices tend to have more highly trained and experienced staffs, and tend to carryout a more complex array of tasks. While the relationships found in this study are in the expected direction and statistically significant, they are not nearly so strong that one can use them to predict, with any degree of certainty, the situation at individual campuses.

There are many limitations to the data in this study which need to be recognized. First, the instrument used to collect the data was designed to be uncomplicated and easily completed. While we collected a great deal of information about structures and functions, we cannot claim to have a complete picture of the operations and activities of the various IR offices. We know that some respondents gave their answers with relative care and completeness, but we suspect that others did not take the time to indicate their activities as fully and as accurately as they might have. Also, we may have missed some professionally challenging activities which, when reported, might have produced a greater spread of scores on the Task Hierarchy. For example, we did not seek detailed information about the technological skills of the staff, nor about their involvement in developing information systems and databases. (Some campuses supplied this in the space for additional responses.)

Second, there are a few characteristics about the data set which probably served to reduce the variance among institutions, thereby reducing the correlation coefficients we examined. For example, there are only 8 large universities in the northeast with enrollments over 20,000, and only half a dozen others with FTEs over 15,000. The relative absence of larger institutions no doubt reduced the variability of the responses. Another factor in reducing the variance is a cluster of about a dozen activities which seem to be carried out by IR offices everywhere (see Table 4). Whether reporting to the President, the Budget Officer, or the Registrar, IR staff are heavily involved in attrition/retention analyses, enrollment management studies, and reporting facts and figures about their institutions both internally and externally. We suspect that the strength of the associations found in the study would have been even greater were it not for these factors.

A third explanation for the mildness of our findings concerns outcomes assessment. The Task Hierarchy gave a high weight to assessment and educational outcomes studies, and these are more often being undertaken by smaller institutions and community colleges, and generally are not being addressed in large universities. And in some larger universities, assessment activities may be taking place, but in a highly decentralized fashion, without heavy involvement by institutional research.

Fourth, we were not able to gather information about the actual sophistication of the special studies which counted so heavily on the Task Hierarchy. We do not know which IR Offices are simply reporting descriptive statistics, and which ones are using conceptual frameworks, building scales, and looking for relationships.

While future studies may be able to correct these weaknesses, we believe that our data and findings nevertheless contribute usefully to our knowledge about ourselves.

THE EVOLUTION OF A STUDENT TRACKING SYSTEM

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INTRODUCTION

Beginning in 1972 Rhode Island College has developed a series of student tracking systems. As the demand for more comprehensive information regarding student flow increased and the College's computing and communications technologies matured, the College moved from a single cohort, manual system through two generations of computer based tracking systems. While the first two systems were designed to track only enrolled students and specifically address student retention issues, the current system tracks all students from the point of application for admission, maintains an historical record of term-by-term student activity, and supports student research on a much broader scale.

Rhode Island College is a public, four-year, comprehensive college which enrolls some 8,500 students in three schools. Approximately 5,500 of these students are degree candidate undergraduates, 550 are degree candidate graduates, and the remainder are non-degree students at both the undergraduate and graduate levels.

VERSION 1

The first student tracking system was initiated in 1972 with the manual tracking of that year's entering freshmen class. This cohort, composed of 1,052 net paid deposit students, was followed for six years. Every semester each member of the cohort was checked to determine his/her current enrollment status (active, withdrawn or not registered, dismissed), and summary statistics were calculated. Although labor intensive and limited in scope this rudimentary system did provide the College with some basic information (Table 1) on its students' dismissal, dropout, and graduation rates. The data showed, for example, that most of our student attrition was the result of students either formally withdrawing from the College or simply not registering, rather than being academically dismissed. By the third semester, 33% of the cohort had either withdrawn or were no longer registered, and 4% had been academically dismissed. The fact that relatively few students were being academically dismissed was not surprising, but the overall rate of attrition was. The College was losing over one third of its students by the third semester, and less than one half (43%) were graduating in four years. Furthermore, the fact that an additional 5% of the cohort graduated in six years, and 2% were still in the pipeline, indicated that more students than expected were taking more than the traditional four years to complete their degree.

As a contextual note, it should be pointed out that at the time there was no office of institutional research at the College and minimal institution-wide interest in student retention. The project was conducted by the Counseling Center, and its results were largely of interest to those in the Student Affairs division. The campus computer center, primarily dedicated to administrative computing, had a staff of nine and, by today's standards, relatively primitive equipment (an IBM Model 360 mainframe with 64K of memory, no on-line transaction processing or programming). Standard statistical packages, such as SPSS, were not available. For the vast majority of faculty and staff at the College electronic data processing was a highly technical field, accessible to only a handful of specialists.

TABLE 1

Undergraduate Degree Candidate Retention Rates
Students Entering as Freshmen
Fall 1972

Student Status	Percent of Originally Enrolled Freshmen By Semester* 1st	3rd	5th	7th	9th	11th	12th
Active	92	63	55	50	9	3	2
Withdrawn/No Register	8	33	41	47	45	49	47
Academic Dismissal		4	5	3	2	3	3
Graduated					43	45	48

*Note: Percentages may not sum to 100 due to rounding error.

VERSION 2

By 1979, a college-wide increase in interest in student retention, brought about in large measure by a growing awareness of the impending demographic changes and its impact on the traditional college student market, was evident. Questions about the representativeness of the 1972 cohort, possible shifts in survival rates over time, and the track record of other groups such as transfer students, once of academic interest to a few, began to have practical implications for the institution. Better information was needed, not only for an improved picture of student retention, but to drive cohort-survival based enrollment projections, another piece of the new enrollment management agenda. Fortunately, by this time there were also resources at the College to address this issue in the form of 1) a new Office of Institutional Research and Planning whose staff members were eager to incorporate computing into its work, and 2) improved computing resources on campus; e.g., the computer center staff had more than doubled in size, the IBM Model 370 mainframe supported on-line transaction processing of student records and programming, and SPSS for statistical analyses was available. This combination of factors supported the decision to implement a computer-based student tracking and reporting system.

The new system which evolved expanded the number and types of cohorts tracked as well as automated the tracking process itself. Each semester a tape was created which contained the admissions records for all net paid deposit undergraduate degree students for that term of entry. At the official enrollment reporting point each semester these tapes were run against the transcript file to capture each student's current enrollment status and summary reports were produced for each cohort. See Figure 1 for a description of the tracking process. This new system allowed the College to:

1. Systematically track as many entering cohorts as desired to determine average retention rates and check for trends over time.
2. Examine subsets of freshmen cohorts; e.g., Male/Female, In-State/Out-of-State.
3. Examine other cohorts in addition to freshmen; e.g., transfer students, second degree students, readmits.

4. Conduct ad hoc studies of student groups not identified on the student data base by merging externally generated files with the student tracking files to create a temporary file for use with SPSS; e.g., student athletes, handicapped students.

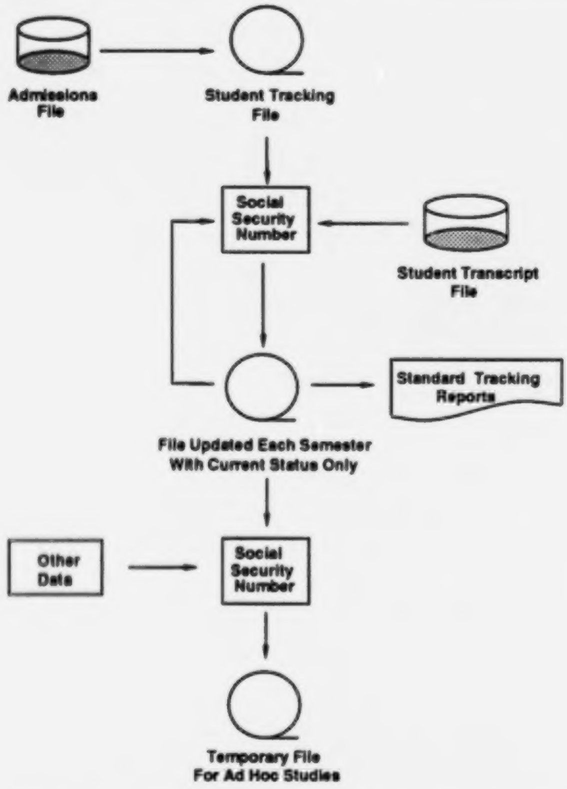

Admissions File
Student Tracking File
Social Security Number
Student Transcript File
Standard Tracking Reports
File Updated Each Semester With Current Status Only
Other Data
Social Security Number
Temporary File For Ad Hoc Studies

FIGURE 1. Student Tracking System: Version 2

This system provided the replications of cohort data needed to estimate term-to-term survival rates for different student populations at the College. With respect to those students who entered as freshmen, the data corroborated the findings for the 1972 cohort, revealing that the survival rates for the different cohorts were remarkably stable over time (Table 2). This was a positive factor for the use of these rates in enrollment forecasting, but a discouraging piece of evidence to those engaged in retention initiatives and looking for positive shifts in retention. As the tracking data accumulated, however, the graduation and survival rates in the ninth semester and beyond clearly showed that over the years students were taking an increasingly longer time to graduate. For example, as of the ninth semester, 43% of the 1972 cohort had graduated and 9% were still enrolled, while for the 1980 cohort 22% had graduated and 31% were still enrolled. As can be seen in Table 2, this trend has continued with students tracked through the ninth semester, to date the 1984 cohort.

TABLE 2

Undergraduate Degree Candidate Retention & Graduation Rates
Students Entering as Freshmen
Fall 1980 - 1988

	Percent of Originally Enrolled Freshmen Active (Graduated) By Semester								
Entering Fall	1st	3rd	5th	7th	9th	11th	13th	15th	17th
1980	92	68	53	47	31(22)	8(36)	4(41)	2(42)	2(43)
1981	92	69	52	46	25(20)	9(34)	5(38)	4(39)	
1982	93	70	56	50	28(19)	10(36)	4(40)		
1983	92	70	53	49	29(17)	11(34)			
1984	93	64	49	46	39(14)				
1985	95	68	55	51					
1986	92	68	57						
1987	93	69							
1988	93								

The information gathered on the different subgroups confirmed some popular notions, but contradicted others. Female students, for example, were found to persist slightly better than male students, a finding consistent with the fact that the College's female students have traditionally had better high school records. Contrary to expectations, transfer students were found to have a graduation rate only some 10 percentage points greater than those students entering as freshmen, despite their earned credit advantage and prior college experience.

As indicated above, a number of ad hoc studies were conducted over the years by creating categories of students using information not found in the student data bases. Student athletes, for example, were found to persist slightly better than non-athletes, but handicapped students not as well as non-handicapped students.

VERSION 3

Despite the great advance the College's first computer-based student tracking system represented, it had several limitations. The most fundamental limitation was one of design; the system was not designed to maintain term-to-term historical data on the student cohorts. Without a history of semester-by-semester student activity all analyses were limited to "snapshots" of a cohort's enrollment status at a point in time. The issue of students taking an increasingly longer period of time to graduate is a case in point. Without historical data on the students' full-time/part-time status and the number of earned credits per semester it was impossible to determine to what extent this phenomenon was a result of an increasing number of students moving to part-time status and/or full-time students reducing their course load.

The second limitation was related to the computing technology available on campus at the time and of a more practical nature. In short, the system was not very flexible or easy to work with. The generation of the standard retention reports was a routine matter once the programming was in place, but anything beyond that required either programming on the part of the computer center or institutional research staff. Programming by the computer center was naturally dependent upon their own set of priorities, while programming by the office of institutional research generally required the additional step of creating a working tape file for use with SPSS. Both always took longer than anticipated, particularly for the institutional research staff whose offices were across campus from the computer center. Although none of these factors in themselves precluded the more extensive use of the data on hand, or even the building of a more sophisticated tracking system, their practical impact was sufficient to inhibit both.

The design of the current student tracking system, begun in 1986, was again the result of the combination of a desire for better information and changing computing technology. In terms of information, the institutional research staff believed that the College would be better served by a tracking system which provided a comprehensive longitudinal picture of student progress that reflected the manner in which students moved into, through, and out of the institution. This new system would be capable of supporting not only more sophisticated research on student retention, but the study of such topics as student academic performance, patterns of curriculum/major change, and admissions/marketing strategies.

With respect to computing technology, a whole new array of more powerful, flexible, and easy to use tools were now available. The office's microcomputers, which had already made a significant contribution to productivity, had recently been linked to a new local area network, allowing the staff to work with mainframe data files (on either the new IBM 4341 or VAX 11/780) from their desktops and to download or upload files if desired. With these advances in the power and convenience of computing, a more sophisticated and easy to use student tracking system appeared practical.

The new longitudinal student tracking was built upon the existing system, the chief modification being the expansion of each student record to include historical data for each term of potential enrollment, including summer session, throughout the tracking period. In addition, the portion of the student record which contained background information was expanded to include financial aid data and certain data elements from the College Board Student Descriptive Questionnaire (SDQ). As with the old system, all undergraduate degree students were to be tracked. Figure 2 describes the tracking process itself, and Figure 3 describes the basic record layout.

Each student record contains data of several different kinds drawn from a number of different student files. A first set of data elements, drawn from the admissions and financial aid files and the College Board SDQ, is compiled once -- at time of entry -- and comprises the first portion of each longitudinal student record. These data elements, generally called "fixed" data elements, contain information on demographics, educational background, and initial enrollment status.

The largest portion of the record contains the semester-by-semester history of the student's enrollment behavior. One set of these data elements is drawn from the student transcript and financial aid files at the end of the add/drop period (2 week point) each semester, and reflects the student's enrollment, financial aid and residential status at that time. Another set of elements is added at the end of the semester from the student master file, and reflect student performance. Most of these data elements are what are called "variable" elements since they change each semester (e.g., semester GPA); a few (e.g;, residence) are termed "semi-fixed" since they vary only occasionally in the course of a student's enrollment. Each student record has the capacity to store ten years of historical enrollment data. This capacity requires a longer record length than we desired, but was dictated by our experience with the old system which showed that 2% of the students from our longest tracked freshmen cohort were still enrolled in their ninth year.

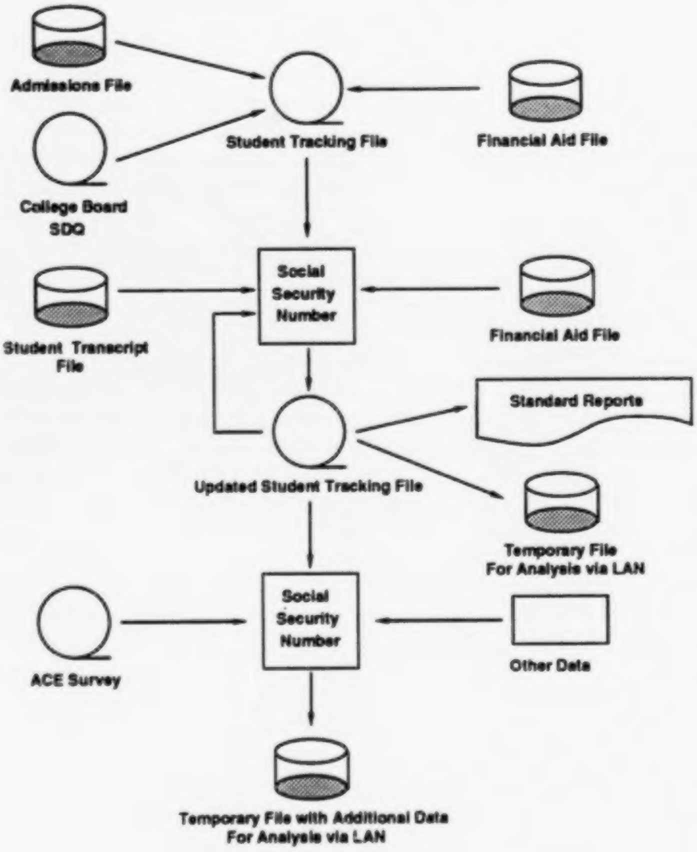
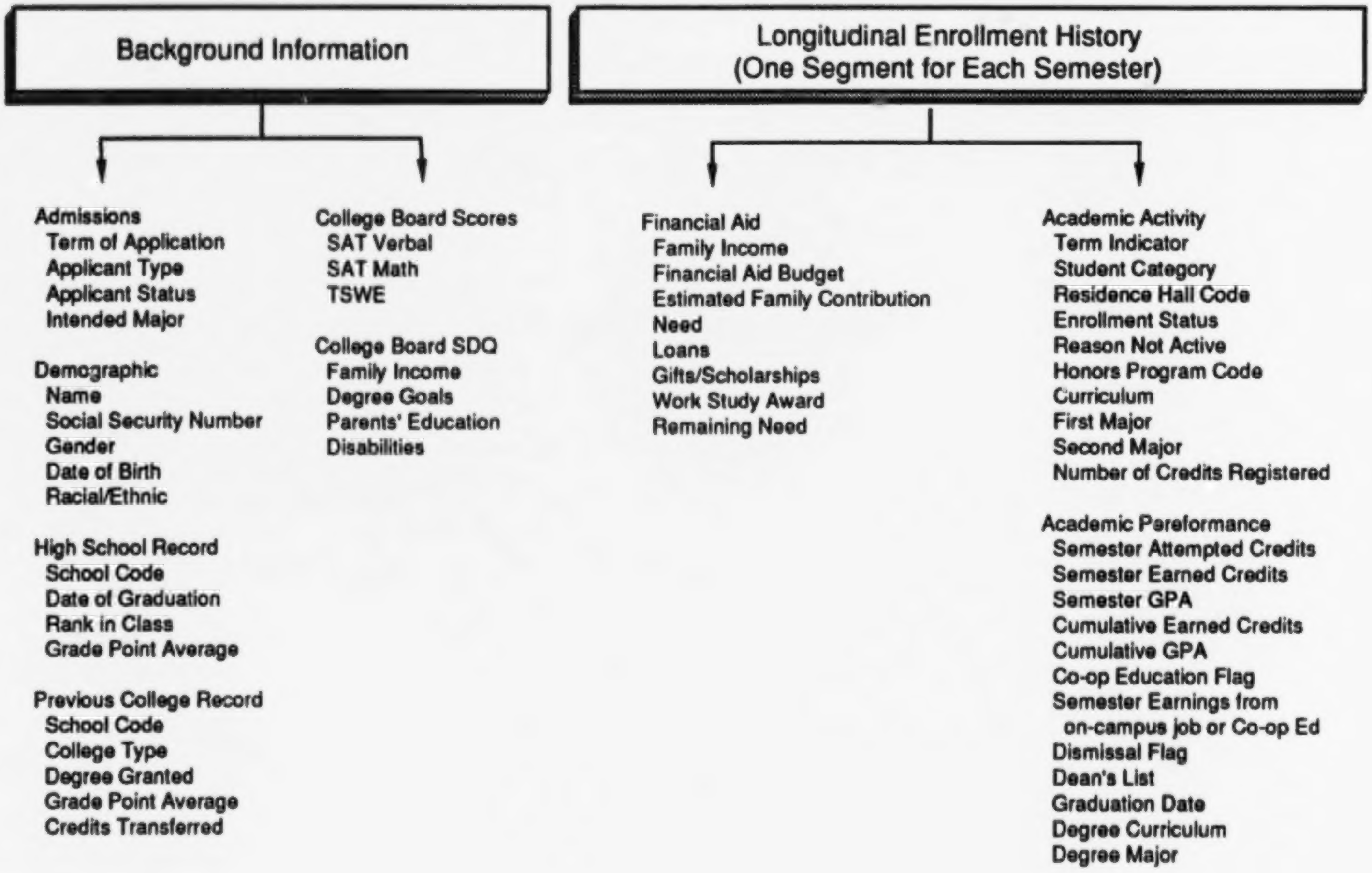

Admissions File
Student Tracking File
Financial Aid File
College Board SDQ
Social Security Number
Student Transcript File
Financial Aid File
Standard Reports
Updated Student Tracking File
Temporary File For Analysis via LAN
Social Security Number
ACE Survey
Other Data
Temporary File with Additional Data For Analysis via LAN

FIGURE 2. Student Tracking System: Version 3

The tracking system is composed of fixed format tape files, one file for each student cohort. Each file for the fall cohorts contains approximately 3,600, 3,500 byte records, one for each student in the cohort. The spring cohorts have the same record format, but about one quarter the number of records. According to this fixed format structure, all tracking information on a given student is maintained in a single record, with portions of the record corresponding to potential semesters of enrollment. Withdrawn and rejected applicant records contain only the fixed demographic and background data, those enrolling contain this initial data and varying amounts of term-by-term data depending upon their length of enrollment at the College. This fixed format record structure, although inefficient in terms of storage requirements, makes for ease of use in transferring the data across machines and facilitates its use with commercial statistical packages. The maintenance and storage of the tape files is the responsibility of the computer center.



Background Information

- Admissions
  - Term of Application
  - Applicant Type
  - Applicant Status
  - Intended Major
- Demographic
  - Name
  - Social Security Number
  - Gender
  - Date of Birth
  - Racial/Ethnic
- High School Record
  - School Code
  - Date of Graduation
  - Rank in Class
  - Grade Point Average
- Previous College Record
  - School Code
  - College Type
  - Degree Granted
  - Grade Point Average
  - Credits Transferred
- College Board Scores
  - SAT Verbal
  - SAT Math
  - TSWE
- College Board SDQ
  - Family Income
  - Degree Goals
  - Parents' Education
  - Disabilities

Longitudinal Enrollment History (One Segment for Each Semester)

- Financial Aid
  - Family Income
  - Financial Aid Budget
  - Estimated Family Contribution
  - Need
  - Loans
  - Gifts/Scholarships
  - Work Study Award
  - Remaining Need
- Academic Activity
  - Term Indicator
  - Student Category
  - Residence Hall Code
  - Enrollment Status
  - Reason Not Active
  - Honors Program Code
  - Curriculum
  - First Major
  - Second Major
  - Number of Credits Registered
- Academic Pereformance
  - Semester Attempted Credits
  - Semester Earned Credits
  - Semester GPA
  - Cumulative Earned Credits
  - Cumulative GPA
  - Co-op Education Flag
  - Semester Earnings from on-campus job or Co-op Ed
  - Dismissal Flag
  - Dean's List
  - Graduation Date
  - Degree Curriculum
  - Degree Major

FIGURE 3. Record Layout for Version 3 of Student Tracking System With Partial List of Data Elements

The new student tracking files are used in two ways. First, as in the past, they are used by the computer center to generate standard reports. Second, upon request, the files, or portions of them, are loaded into the mainframe account assigned to the Office of Institutional Research for analysis using SAS. The programming, running, and viewing of the output from the SAS programs are done on the institutional research office microcomputers via the local area network. SAS output can be either spooled to the high speed printers at the computer center or downloaded to the office microcomputer for local printing.

Currently, the standard reports give summary enrollment status statistics on a number of student categories (e.g., freshmen, transfers, honors students) every semester. These reports will be expanded to include other categories of students and to look at academic performance variables, such as earned credits and GPA, as well as enrollment status. Studies of cohort data loaded into the Office's account have been begun to explore such issues as the pattern of student flow between programs over time (see Tables 3 and 4), retention rate and academic performance by age, and the relationship between residence and academic performance and retention. With the accumulation of data over time -- we currently have semester-by-semester data only as far back as the cohort entering in the fall of 1985, College Board SDQ data beginning with the fall 1988, and financial aid data from 1989 -- the system should provide the basis for a continuing series of ad hoc studies. This year the Office plans to order a tape of the results of the 1989 American Council on Education Student Information Form, administered to the College's entering freshmen and transfer students; merged with the student tracking file for that cohort it will add extensive information on student high school behaviors and attitudes to work with in future studies.

FUTURE DIRECTIONS

As has been the case since its inception, the tracking system continues to evolve. In addition to expanding the standard reports available from the system and continuing with ad hoc studies, a number of design changes are in the planning stages. The most immediate goal is to move the tracking files from tape to the mainframe disk area. This would make the operation more efficient at the computer center level by eliminating the need to move data from the tracking files to the Office's mainframe account for statistical analysis, and would make the entire database in its most updated form immediately accessible to ourselves and others on campus via the local area network. Consideration is also being given to adding to the record data elements which identify the specific courses taken by students, and fields for capturing outcomes data on those students who graduate (e.g., location and type of employment, satisfaction with their educational experience). The addition of course information, which is readily accessible from the existing student transcript file, is seen as an achievable, near-term goal. The inclusion of student outcomes information is a longer-term objective, for it will require an examination of what data elements are currently available, the feasibility of collecting those which are not, which elements can be added to the student record itself for routine reporting, and which would be more appropriately maintained in a separate file for periodic analyses.

Note: The author wishes to acknowledge the continued assistance of Donna L. Konicki, Manager of Systems Development, in the design and implementation of the computer-based student tracking systems at Rhode Island College.

TABLE 3

Rhode Island College
Fall 1985 Freshman Cohort
Sixth Semester Status By Curriculum

Disposition of Student Cohorts by Original Curriculum Choice

Curriculum Choice Fall 1985	Number Enrolled Fall 1985	Active in Original Curriculum		Active in Another Curriculum		Total Active	
		N	%	N	%	N	%
Liberal Arts	344	121	35%	72	21%	193	56%
Elementary Education	86	33	38%	22	26%	55	64%
Secondary Education	13	5	38%	2	15%	7	54%
Industrial Education	11	4	36%	0	0%	4	36%
Other Education	16	4	25%	7	44%	11	69%
Management	149	55	37%	22	15%	77	52%
Medical Technology	29	7	24%	9	31%	16	55%
Nursing	75	28	37%	20	27%	48	64%
Social Work	26	9	35%	5	19%	14	54%
Undecided	217	19	9%	86	40%	105	48%
Other	11	2	18%	3	27%	5	45%
Continuing Education	na						
Total	977	287	29%	248	25%	535	55%

In/Out Migration of Active Students by Curriculum

Curriculum Choice Fall 1985	Lost From Orig. Cohort	Gained From Other Curricula	Net Gain/Loss	Active in Original Curriculum	Total Active	Total as a Percent of Original Cohort
Liberal Arts	72	61	-11	121	182	53%
Elementary Education	22	26	4	33	59	69%
Secondary Education	2	16	14	5	21	162%
Industrial Education	0	7	7	4	11	100%
Other Education	7	17	10	4	21	131%
Management	22	43	21	55	98	66%
Medical Technology	9	0	-9	7	7	24%
Nursing	20	6	-14	28	34	45%
Social Work	5	6	1	9	15	58%
Undecided	86	27	-59	19	46	21%
Other	3	3	0	2	5	45%
Continuing Education	0	36	36	0	36	na
Total	248	248	0	287	535	55%

TABLE 4

Rhode Island College
Fall 1985 Freshman Cohort
Student Migration
Original Curriculum To Declared Curriculum In Sixth Semester

Curriculum Declared in Sixth Semester

Original Curriculum	Liberal Arts	Elementary Education	Secondary Education	Industrial Education	Other Education	Management	Medical Technology	Nursing	Social Work	Undecided	Other	Continuing Education	Total
Liberal Arts	121	12	6	3	6	21	0	2	3	6	2	11	193
Elementary Education	3	33	1		2	2			1	9		4	55
Secondary Education	1	1	5										7
Industrial Education				4									4
Other Education					4					6		1	11
Management	11		1		1	55				1	1	7	77
Medical Technology	3	2	1		2		7	1					16
Nursing	6	2		1		1		28	1	5		4	48
Social Work	1	1	1			2			9				14
Undecided	33	8	6	3	6	17		3	1	19		9	105
Other	3										2		5
Continuing Education													
Total	182	59	21	11	21	98	7	34	15	46	5	36	535

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THE MIGRATION OF A DATA BASE PROJECT FROM A PRIMITIVE PERSONAL COMPUTER TO A STATE-OF-THE-ART SYSTEM

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INTRODUCTION

Computer technology continues to advance at a rapid pace that increasingly requires institutional researchers or others working with large data bases, extensive spread sheets, documentation to migrate or transfer files between computer systems with minimum loss of time. Institutional researchers who perform this transfer usually accomplish it by simply obtaining a hardware network connection and a software disk from their local university computer center and typing a set of prescribed commands. But, what is a hardware connection and what's on the disk and why these particular commands?

It is the purpose of this presentation to take some of the mystery out of this process by showing, step-by-step, what is involved in moving files between computers. The presentation is based, in part, on Chapter 10 of the book, People and Computers (Vinsonhaler, Wagner, and Gentry, 1989).

File migration will be discussed from the perspective of the transfer of a single word processing document from the Doctoral Institution Data Base (Vinsonhaler, J. C., 1986) project from a primitive, but extensively super-charged, Apple IIe microcomputer to a Tandy 1000 (an IBM PC compatible or clone) microcomputer and finally to a state-of-the-art system, the IBM PS/2 Model 80.

The presentation will be in two parts. Part 1 will present an overview of the DIDB project which made the file migration necessary. Part 2 will describe the file migration process itself, beginning with a thorough discussion of file transfer between hardware incompatible computers, followed by a briefer discussion of file transfer between hardware compatible computers, and concluding with remarks relative to communication between personal computers with modems and between personal computers and mainframes.

FILE TRANSFER BETWEEN HARDWARE INCOMPATIBLE COMPUTERS

As the reader is probably aware, a personal computer (PC) is not just a cabinet or keyboard, but rather is essentially a combination of a microprocessor chip and a main circuit board. The main circuit board design includes the standard bus (i.e., a communication line shared by computer hardware) architecture which establishes the basis for information transfer. For example, the older IBM PC compatibles use ISA (Industry Standard Architecture), Compaq uses EISA (Extended ISA), and IBM uses MCA (Micro Channel Architecture).

Hardware incompatibility refers to the fact that two computers incorporate different hardware designs and have different internal methods of representing information. This is the case when two computers have different main circuit board designs with different input and output conventions and different microprocessor chips. The result is that information from the first computer can not be read directly by the second computer without some modification. In this paper, the focus is on two widely used hardware incompatible systems, the Apple II family and the IBM PC compatible family. However, the points made hold for any hardware incompatible systems. Here, we are not dealing with all possible ways of exchanging information, but only with the most typical.

The file migration process illustrated is the transfer of a single file from an Apple IIe microcomputer to a Tandy 1000 microcomputer, since this illustrates nearly all of the steps which must be taken in transferring information between any two hardware incompatible computers, whether mainframe, minicomputer or microcomputer. It should be noted, however, that "hardware incompatible" is a relative term (i.e., a matter of degree), since microcomputer programming can be used to change the way hardware architecture funcions at the most fundamental level.

A. Required Hardware Components for Communication Between Hardware Incompatible Computers.

Communication between any two incompatible computers requires several basic hardware and software components. The hardware components consist of: two computers (two microcomputers in the present discussion), two communication boards, two cables, and a null modem to connect the two computers. Figure 1 below shows an overview of these required hardware components. Table 1, also below, summarizes and defines the functions of these hardware components.

Basically, as may be seen from the figure and the table, the key hardware device is a communication circuit board or card which provides a convenient way to convert the unique internal representation of information to a standard form that communication boards on other computers can read and understand.

Figure 1. Overview of Hardware Components Required For File Transfer Between Two Microcomputers.

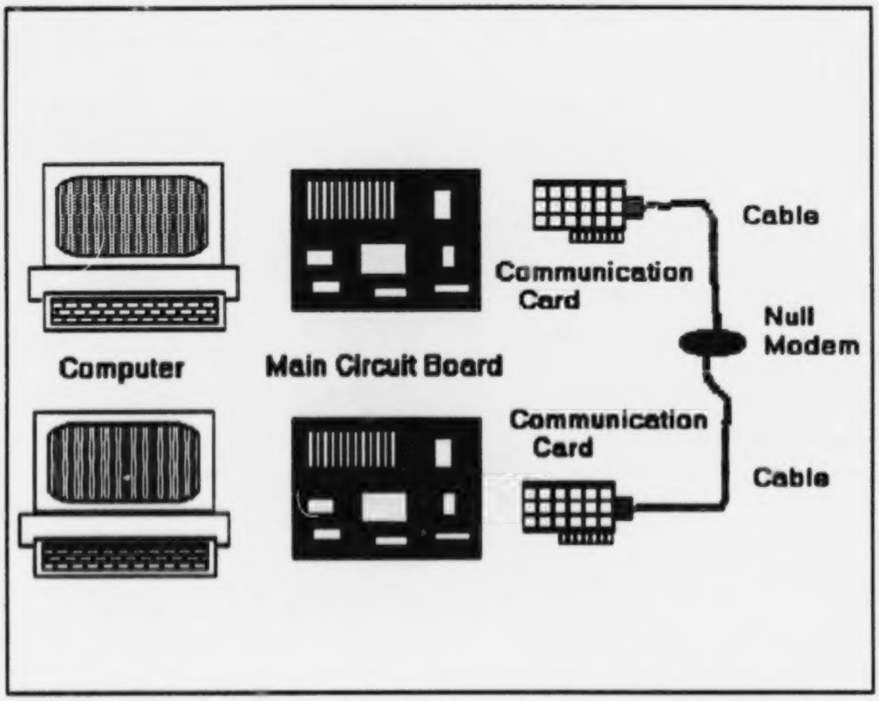

Cable
Communication Card
Null Modem
Computer
Main Circuit Board
Communication Card
Cable

Table 1. Description of Hardware Components Required for File Transfer Between Two Microcomputers.

Computer Components and Functions	Apple IIe Microcomputer	Tandy 1000 Microcomputer
Microprocessor chip on the main circuit board. The "brain" of the microcomputer.	Motorola 6502 microprocessor chip on the main circuit board.	Intel 8086 microprocessor chip on the main circuit board.
Expansion slots or ports. Used for control of communications, input and output (I/O), additional memory, etc.	8 expansion slots or ports (i.e., 0,1,2,...,7). For communication and other circuit boards.	5 expansion slots or ports (e.g., COM1,COM2,..). For communication and other boards.
Communication circuit board. Controller boards are used to convert information from an unique internal microprocessor representation to a common standard communication representation. Also includes a connector for a matching cable.	Apple super serial communication controller card. Card converts from the unique Apple IIe representation to the standard (RS-232C) representation. Board is plugged into any of the 1...7 slots (e.g., Slot 2). Includes a RS-232 cable connector (e.g., 25-pin female).	IBM compatible serial communication controller card. Card converts from the unique IBM PC representation to the standard (RS-232C) representation. Board is plugged into any I/O slot, (e.g., COM1 or COM2). Includes a RS-232C cable connector (e.g., 9-pin male).
Cables and null modem. Cables must have connectors which match those of the communication board. The Null Modem is the interface between the connecting cables.	Cable from the super serial card connector to the null modem. Cable and board connectors must match (e.g., an RS-232 male plug with 25-pins).	Cable from the null modem to the IBM compatible serial communication Board. Cable and board connectors must match (e.g., an RS-232 female plug with 9-pins).

Problems: "Which cable, Mable?" or "A Pain in my Backpane."

All of the hardware described has to match, including boards, plugs, pins, etc. A common problem is that some sales people, in blissful ignorance, will happily sell you the wrong boards, i.e., the board won't plug into any of the slots (called the backpane) in the main circuit board, as well as incorrect cables for your PC. They will even sell you cables with the wrong number of pins (e.g., the number of pins in the cable, say 9, is different from the number of pins in the board, say 25). Another common hardware problem is setting "dip switches" (i.e., tiny switches on communication boards which control the communication functions of each pin). These dip-switches must be correctly set to the values recommended in the manual, e.g., in the present case, for direct, rather than modem, communication.

B. Required Software Components for File Transfer between Hardware Incompatible Computers.

The required software components for each computer system (operating system, application system, and communication system) are summarized in Figure 2 and defined in Table 2.

Software needed for communication consists of the operating system, which is necessary to operate the computer hardware, application software, which is necessary for data processing (e.g., word processing, data base management, statistics, and so on), and communication software which is necessary to use the communication circuit board.

As may be seen from the figure and table, the key piece of software is the communication software package. There are many in common use. Kermit (Gianone, 1988) is the system most commonly used for communication between PC's and mainframes in the academic environment, because versions exist for nearly any type of mainframe, mini, or micro computer. SMARTCOM I by Hayes is widely used in the PC business community. PROCOMM is a very powerful communication package well suited for general use (Datastorm, 1986). The latter two communication software packages were used in the present demonstration. Regardless of the package(s) used, however, the principles are the same.

Figure 2. Software Required for File Transfer Between Hardware Incompatible Computers.

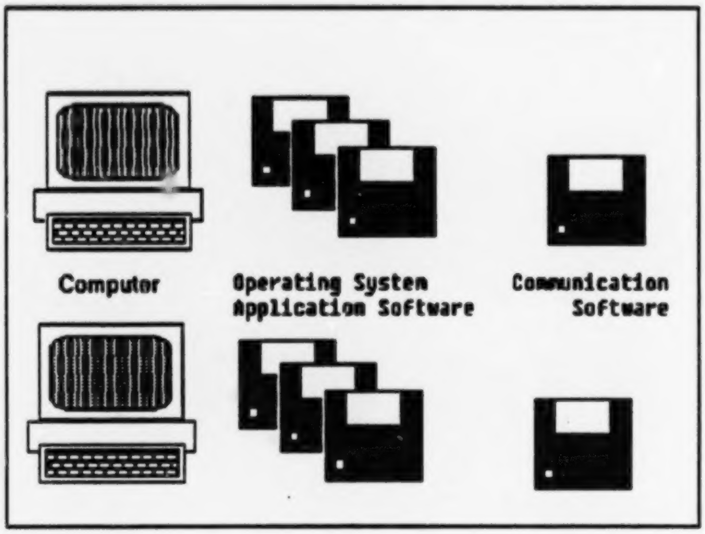


Table 2. Description of the Software Components Required for File Transfer Between Two Microcomputers.

Type of Software System Used and Major Functions	Software Used on the Apple IIe Microcomputer.	Software used on the Tandy 1000 Microcomputer.
Operating System. A set of programs which operates the hardware, e.g., controls all file handling, such as file copying and saving.	PRODOS. Has unique file format and methods of file handling, different from those of other operating systems.	MS/DOS. Has unique file format and methods of file handling, different from those of other operating systems.
Application System. A set of programs used for data basing, spread sheeting, data analysis, graphics, and word processing. Must be compatible with the operating system in use.	AppleWorks. Supports data basing, spread sheeting, data analysis, and word processing using PRODOS files. Reads and writes PRODOS files. Used with Apple IIe, IIc, and IIg microcomputers.	Lotus 1-2-3. Supports data basing, spread sheeting, data analysis, and graphics. Word Perfect 5.0. Supports word processing. Both read and write MS/DOS files and are used with IBM PC or PS/2 microcomputers.
Communication Software. A set of programs which allows users to operate the microcomputer and to communicate and transfer files between computers.	Apple IIe Version Of SMARTCOM I. Allows the Apple IIe to use its RS-232C controller card to exchange files or messages with other computers.	IBM PC Version of PROCOMM. Allows the Tandy 1000 to use its RS-232C controller card to exchange files or messages with other computers.

Problems: "You Bought a WHAT?" or "Ask Microsoft. It's Their Fault."

In the file transfer process under discussion, there are potentially four different brands of hardware (i.e., two types of computers, each with two kinds of boards) operating with six different brands of software (i.e., two each of operating, application, and communication software packages). When problems arise, as they frequently do, there is the great temptation for a technical representative from one company to blame another company for the problem. This is especially the case if one buys a computer from a less than well-known manufacturer. A good example of this problem is trying to find out which system is removing line feeds and carriage returns. Everybody points at everybody else. As in the case of other problems, a good local retailer or your computer lab can usually sort the thing out.

C. The Communication Process

Communication between humans requires a common language and a set of agreements or conventions about the communication process, i.e., that both will not talk at the same time, that both will talk loud enough to be heard by the other, and so on. Similarly, there must also be a common language and agreed upon conventions for communication between computers. The user must identify and specify these to the communication software. They are indicated below.

1. Hardware Configuration.

   The communication software must be accurately told about the hardware devices and how they are connected or configured, i.e., what slots or ports are used, what types of communication controller cards are used, etc. In the present example, PROCOMM must be told that the IBM serial communication controller card is in slot COM2 of the PC and SMARTCOM I must be told that the super serial communication controller card is in slot 2 of the Apple IIe.

2. Standards, Parameters, and Protocols.

   The two communication software systems must be set to use the same standard for information exchange, communication parameters, and protocols. If any of these do not match, communication is impossible.

   In the example, the two computers are using the same standard for information exchange, the RS-232C standard, which designates what wires (pins) are to be used to carry what information, the voltage to be used, etc.

   Parameters are a set of options that control how the signal travels along the cable. Many different parameters can be used, but they must also be the same for both communication software systems. The most common parameters for direct communication between computers are probably the following:

   Baud: 1200, 2400, 9600 or higher
   Parity: None
   Number of Data Bits: 7 or 8
   Number of Stop Bits: 1

   In the example, both PROCOMM and SMARTCOM I used the following parameters:

   9600, N, 8, 1.

   File sending protocols are agreed upon procedures: for breaking files into packages or blocks, for sending blocks, and for verifying that blocks were correctly received or, if not received, for resending them. Any of several protocols are commonly used, but both communication programs must be using the same one. In this example, the XMODEM protocol is used.

3. Device, Directory and File Names.

   The file sending system must be told the name of the storage device to be used in the file transfer, the name of the directory containing the file to be transferred, and the name of the file to be transferred. For example, with SMARTCOM I the following might be specified: Slot 1, Drive 2 as the device; \DIDB as the directory; and ABSTRACT.MS1 as the name of the file to be sent.

   Similarly, the file receiving software needs to know the device, directory, and file names. For example, for PROCOMM the following might be specified: Drive C, \DIDB again as the directory, and \ABSTRACT.MS2 as the new name of the file to be received.

D. Script for the Migration of a DIDB File Between an Apple IIe Microcomputer and a Tandy 1000 Microcomputer.

The following is a script illustrating the transfer of the file originally on the Apple IIe, now on the Tandy 1000, to the IBM PS/2 Model 80, using MS/DOS and Word Perfect 5.0.

1. Preparing an ASCII Text File.

   The first step in transferring a file is to use an application software package to translate the file into a standard format. Such a file contains only standard characters of the alphabet, numbers from 0 to 9, common punctuation, and a few special characters recognized by all printers, such as carriage returns and line feeds. In the present example, AppleWorks software is used to translate the file into an ASCII (American Standard Code for Information Exchange) text file.

   To accomplish this, use AppleWorks menus to retrieve the DIDB text file to be transferred from the disk and then re-write it on the disk as an ASCII PRODOS text file.

2. Second, the communication process itself can be carried out. Since the procedure is almost identical for both microcomputers, the procedure will be described in detail only for the receiving microcomputer (the Tandy 1000 microcomputer with PROCOMM communication software).

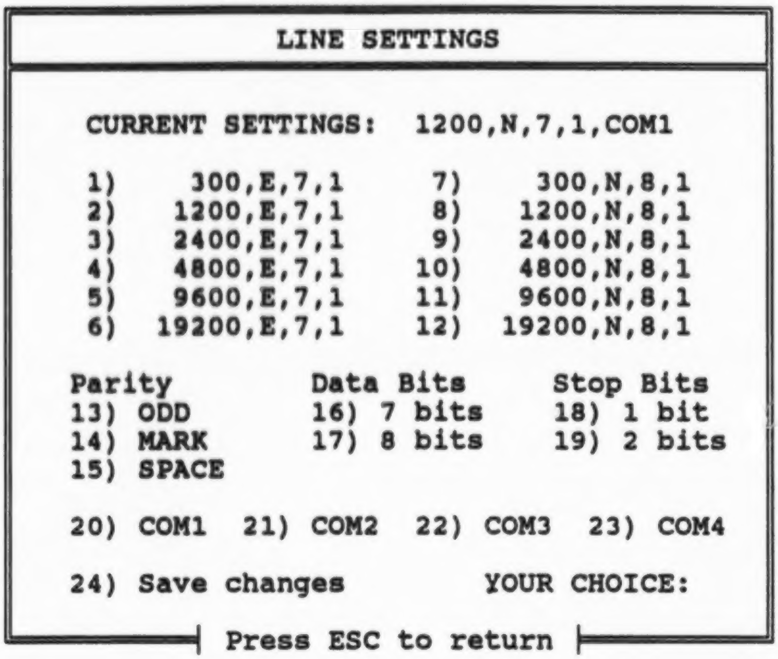
   Graphics are used to illustrate the menus to be used to set the parameters and to receive (or send) the file with PROCOMM. (Note: In the interactions which follow, "Y" will be used to indicate the user and "C" will be used to indicate the microcomputer.)

   Y: Boot the PROCOMM communication software on the TANDY 1000 microcomputer.

   C: PROCOMM displays the communication screen with the default parameters.

   Y: Select the Main Menu (Help Screen) to find the keys for the needed commands. (The Main Menu displays all of the commands available to the user).

   Y: Press ALT-F9 to select the Line Settings menu.

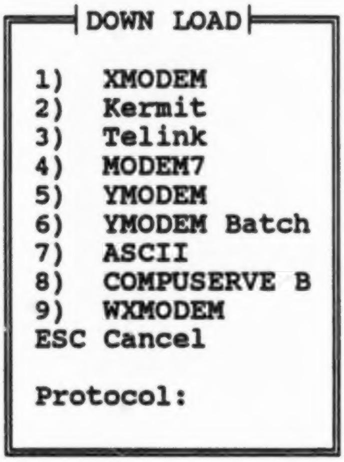


```
                    LINE SETTINGS

   CURRENT SETTINGS:  1200,N,7,1,COM1

   1)    300,E,7,1      7)    300,N,8,1
   2)   1200,E,7,1      8)   1200,N,8,1
   3)   2400,E,7,1      9)   2400,N,8,1
   4)   4800,E,7,1     10)   4800,N,8,1
   5)   9600,E,7,1     11)   9600,N,8,1
   6)  19200,E,7,1     12)  19200,N,8,1

  Parity          Data Bits     Stop Bits
  13) ODD         16) 7 bits    18) 1 bit
  14) MARK        17) 8 bits    19) 2 bits
  15) SPACE

  20) COM1  21) COM2  22) COM3  23) COM4

  24) Save changes        YOUR CHOICE:

          Press ESC to return
```

Use the Line Settings menu to set the parameters: 9600 Baud, No Parity, 8 Data Bits, 1 Stop Bit, COM2 (slot used for the communication card).

3. Y: Select Receive File mode (DOWN LOAD).

Y: Press the Page Down key to display the file transfer or DOWNLOAD menu.



```
    DOWN LOAD

1)   XMODEM
2)   Kermit
3)   Telink
4)   MODEM7
5)   YMODEM
6)   YMODEM Batch
7)   ASCII
8)   COMPUSERVE B
9)   WXMODEM
ESC Cancel

Protocol:
```

Y: Select XMODEM

XMODEM is a widely used protocol with good error checking. It is the one selected here for PROCOMM. This means that the same protocol must be used by SMARTCOM I to send the file. Entering 1 causes the program to use the XMODEM file transfer protocol and to request the user to enter the drive, directory, and file names to be used with the new file, for example:

C:\PROCOMM\ABSTRACT.MS2) as shown below.

```
   Receive XMODEM

  Please enter filename: ABSTRACT.MS2
```

ALT-F10 HELP|ANSI-BBS|HDX|1200 N71|LOG CLOSED|PRT OFF|CR|CR

4. At this point, the Tandy 1000 microcomputer and PROCOMM are set up for the communication process. Before beginning the communication process, however, the user must set up the Apple IIe microcomputer by repeating all of the above steps, using the SMARTCOM I menus. The only difference is that the SMARTCOM I program must be instructed to Download or send the file. All of the line parameters and the protocols, etc., must be the same.

5. Once both computers are ready, the communication process can be initiated (usually, by pressing Enter on both computers). This causes SMARTCOM I to use the communication controller card to open a connection and begin sending the file to PROCOMM on the Tandy 1000 microcomputer.

6. The two programs report progress on the screen of the computer by indicating blocks transferred, errors occurring, etc., and beeping when the transfer is complete. The screen below shows the file transfer as reported by PROCOMM.

```
          PROTOCOL: XMODEM
         FILE NAME: ABSTRACT.MS2
         FILE SIZE:
       BLOCK CHECK:
     TRANSFER TIME:
 BYTES TRANSFERRED:
BLOCKS TRANSFERRED:
    BLOCKS IN FILE:
       ERROR COUNT:
      LAST MESSAGE: NONE
```

7. Once file transfer is complete, a file display command can be used to check the file transferred. The display will show that the ABSTRACT.MS2 file is now in MS/DOS ASCII format suitable for use with Word Perfect or other PC compatible software. Most of the formatting will have been lost, however, and will have to be replaced.

8. Finally, the Exit commands on both microcomputers are used to break the electronic line connection and close-down the microcomputers.

9. At this point, a file containing the document stored as an MS/DOS (ASCII) TEXT file is resident on the Tandy 1000. What remains to be done is to transfer the file from the Tandy 1000 to an IBM PS/2 Model 80 in a Word Perfect 5.0 format. This process will serve to illustrate the second major type of communication between computers.

FILE MIGRATION BETWEEN HARDWARE COMPATIBLE COMPUTERS.

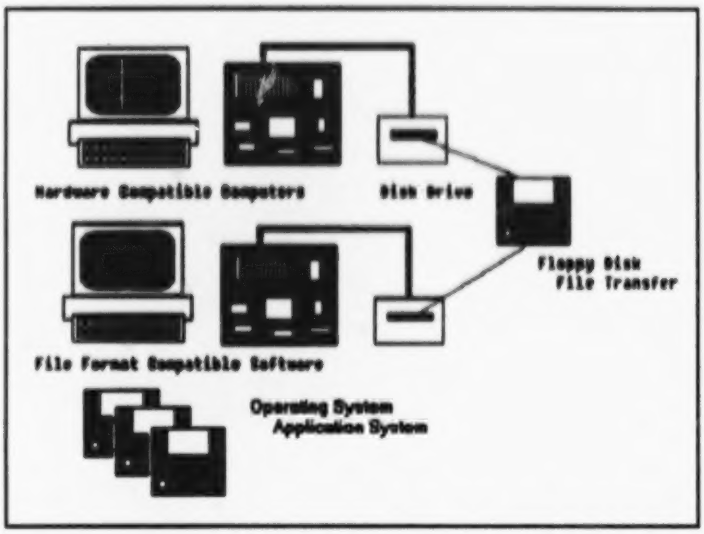
Hardware compatible computers may be defined as computers which have identical or compatible internal representation of information. This is the case when both computers use the same bus architecture on the main circuit board and the same microprocessor chip. Thus, all IBM PC compatibles are hardware compatible since they all use the Industry Standard Architecture (ISA) bus design and the Intel 8086 family of microprocessor chips. Because hardware compatibility has proved so valuable to users, successive generations of computers (e.g., the IBM PC-PCAT or PS/2 family or the Extended ISA family) are designed to be at least sufficiently hardware compatible as to process the same files in identical ways without any translation.

The ability to process files identically means that one can transfer files directly between the two computers, e.g., by taking a floppy storage disk written by one computer and reading it with another. Thus, the only problem remaining is software compatibility, i.e., the software on the two machines must be able to process the same file identically.

A. Required Hardware Components for Communication Between Hardware Compatible Computers.

The only components required for file transfer between hardware compatible computers are a physical medium for transferring files, compatible operating systems, and compatible application software.

Figure 3. File Transfer Between Hardware Compatible Computers.



In the example, there are two compatible computers, a Tandy 1000 and an IBM PS/2 Model 80, the same operating system on both computers, MS/DOS 3.3, and the same word processor, Word Perfect 5.0. The physical medium in this case is a 3.5 inch floppy diskette.

B. The Communication Process.

The communication process is simple. The compatible software is used to write the file on disk with one computer and then read it with the other computer. In the present example, the file was written by PROCOMM as a MS/DOS TEXT file on the Tandy 1000 and then the Word Perfect 5.0 application software on the Tandy 1000 translated the MS/DOS TEXT to the Word Perfect 5.0 format ordinarily used by the application software. Then, because the file with which we are dealing has probably been stripped of most of its control codes and, additionally, has probably had errors introduced to it, some manual editing may now be necessary.

One can manually edit the file and insert the control codes (e.g., paragraph marks, hard carriage returns, paragraph indentations, printer control codes, etc.) or software can be used to assist in the process. For example, at the simplest level, spelling checkers can be used to find missing spaces, stray characters in the file, etc. or a more advanced spelling/style/grammar checker, such as Grammatik III (Morris, 1989), can be used for these and other problems.

C. Script for the file migration process.

Again, a script will be used to illustrate the transfer of the file originally on the Apple IIe, now on the Tandy 1000, to the IBM PS/2 Model 80, using MS/DOS and Word Prefect 5.0.

1. The MS/DOS file, written by PROCOMM as a text file (ABSTRACT.MS2) is now resident on the Tandy 1000.

   Y: Use MS/DOS to write the file to a floppy disk: Copy C:ABSTRACT.MS2 B:

   Y: Remove the floppy disk from the Tandy 1000.

   Y: Boot Word Perfect 5.0 on the IBM PS/2 Model 80 computer and insert the disk in the drive. Use Word Perfect 5.0 to read the file as a DOS text file. Word Perfect 5.0 automatically converts from ASCII text format to Word Perfect 5.0 format.

2. The file is now on the IBM PS/2 Model 80 in the proper word processing format and can be processed like any similar file.

SUMMARY AND CONCLUSIONS

The typical transfer of data files between different computers and software systems is closely analogous to the process described. There are only a few differences. First, data files are prepared for transfer using data base or spread sheet software available on the first computer. Second, the files are transferred using optional formats for transferring data. For example, data can be transferred as an ASCII file as with a word processing file, or a standard format especially designed for data, such as the Data Interchange Format (DIF). As before, the main point is that the same or compatible formats must be used with both the sending and receiving computers. Finally, the files are converted by the application software on the second computer to the desired format.

Most commonly used communications between other types of computers can be understood as variations on the procedure described here for communication between two personal computers.

A. Communication Between Personal Computers with Modems.

Communicating over long distances using public telephone lines is the same as the present example of communicating between hardware incompatible computers, except that, instead of connecting the computers with a null modem, real modems are used on both machines. Each modem is connected to the phone network by means of an ordinary phone jack. Everything else is essentially the same. In addition, a special dial command is used to cause the communication software to dial the telephone number of the receiving computer.

B. Communication Between Personal Computers and Mainframes.

Communicating with mainframes can take two forms: modem or hard wired. Modem communication is the same as in the present example except that the mainframe has enough modems to accommodate many users simultaneously. Also, the mainframe operating systems and associated communication software generally have many more capabilities than PC's.

Hard wired or local networks are similar to the micro to micro example described above, except that a local hard wired network is used. The set-up is similar to the cable-to-null-modem connection also described above except that the cable is attached to a mainframe or minicomputer instead of to a null modem. Communication boards and software are also necessary, but there is no need for the null modem.

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Surveys and Computer Advances: "Application of Technology to Enhance the Productivity and Impact of the Sample Study in a Small Research Office

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I. Introduction

Institutional research, as a function which "links the educational, managerial, and information" aspects of higher education, has undergone tremendous changes in the past three decades. Historically, institutional research can be viewed in three stages: 1) emergence in the 50's and 60's 2) growth and consolidation in the 70's and 3) fragmentation in the 80's (Peterson, 1985).

Even as institutional research officers emerged and grew, for the most part the primary reason for their existence changed only slightly.

> "The analysis and interpretation of institutional records and data plus the occasional or periodic studies that are necessary to supplement routine recordkeeping and reporting, would thus seem to be what institutional research is all about (Fincher, 1985)."

Of course, the size and impact of institutional research varied greatly from campus to campus contingent primarily upon how administrative leaders viewed this function and the role and influence they assigned institutional research in policy making, planning, management and evaluation.

For many colleges who employ an institutional research office of one or two persons, the quantity, and to a lesser degree the quality of research is directly affected by this modest size. This was especially true during the early years of the 50's and 60's when much of the data and the accompanying analysis required hand-tabulation, a costly and labor intensive activity. Thus, it is apparent that small institutional research offices had to either grow or the amount and/or sophistication of each project had to be in congruence with the abilities and productivity of the small incumbent staff.

However, with advances in computer technology, many activities and responsibilities not heretofore attainable or even considered are now within the confines of even the most modest size office. This is especially true in the area of microcomputers as advanced hardware and software have been developed and proliferated. Research has moved from simple counting and descriptive studies to the use of powerful multivariate analyses, planning and forecast modeling, and budget/fiscal management/decision making process to cite just a few examples of the influence this new technology have and continues to play in the field.

One area where microcomputers and their accompanied software packages have had a profound impact is in survey research. This has special significance for the smaller institutional research office where restricted staffing and financial restraints, along with the generally descriptive only analysis resulted in past surveys which were limited in their scope and value. The increase in surveying and also the ability to analyze in greater depth and the consideration of multiple factors when tackling a research question or probing an institutional problem can be directly attributed to the development of the powerful microprocessor and high capacity software. Discussion will now follow related to the application of PC technology to enhance survey research in a small one man office.

II. Sample Problem

During the Fall 1988 Semester, a number of institutional projects were presented to the Research Office at Harrisburg Are Community College (HACC). While each request varied in style and purpose, two common elements were present. First, all requests sought information. Not only information but data that could only be gotten through a survey. Second, each request also included the expectation that the Research Office would complete or aid in the completion of all data analyses.

Since staffing consisted of one full-time professional, a half-time research assistant, and one student worker, the ability to obtain information, create a useable data file, perform the required analysis, and then report on the result in a timely fashion was critical. The following lists the projects and requesting agency or office (in parenthesis):

1) First Time, Full-Time Student (President's Office)
*2) Twenty-Four Month Graduate Follow-Up (PA Dept. of Education)
*3) Non-Returning Student Survey (Office of Civil Rights)
4) High School Student Survey (Admissions Office)
5) Student Assessment of Registration (Registrar's Office)

*On-going annual survey.

While the five studies required both the creation of a questionnaire and completion of the survey, primary focus will be to highlight only the Twenty-Four Month Graduate Follow-Up. This particular survey was selected because it was the only one of the five to utilize the pre-printed optical-scanning format as well as fully incorporating the advantages of a data-base file and a statistical package.

III. Utilizing the Optical Scan Format Option

The creation of HACC'S Twenty-Four Month Graduate Follow-Up survey was due to the reporting requirements of the Pennsylvania Department of Education (PDE). Since the information requested from PDE varied little and reports were submitted on an annual basis, this suggested that a pre-printed custom optical scan format would be ideal. The survey instrument was written by the Research Office following the data requirements of PDE and local information sought by HACC administrators.

Once the questions were finalized, a mock-up of the proposed optical-scan format was created by the Research Office. Expertise used to complete mock-up was gained during a free two-day workshop provided by the vendor of the optical-scan form (considerable dollar savings was also realized by the in-house completion of the mock-up).

Before moving to the creation of the data file, several important points related to the optical scanning format must be mentioned. First, as noted previously, surveys which must be conducted at regular intervals and require no changes are best suited for this format. Sample size is also another important consideration. Second, on-campus computer support, while not required, proved to be very valuable. This was especially true when programming the scanner in the BASIC computer language was needed (optional: scanner program plus other software support can be purchased through vendor). Finally, while the optical scan format expedited the collection of the data and creation of the data file, initial cost must also be considered. Hardware cost for the scanner ran to $3,000; optical-scan surveys about $1,000 (this includes a one-time only $200 fee for editing) for 5,000 copies; and time required for the workshop training. In addition, other costs may include scanner program and mock up charges (less if completed in-house) plus all supporting PC hardware. The vendor did encourage in-house support efforts to hold down costs.

Certainly, initiating any survey to be placed on an optical scan format must be undertaken only after questions such as what, how, cost, benefit, etc. have been reviewed and answered. To do less may invite an expensive lesson in coping with "technological chaos" (See Appendices A & B).

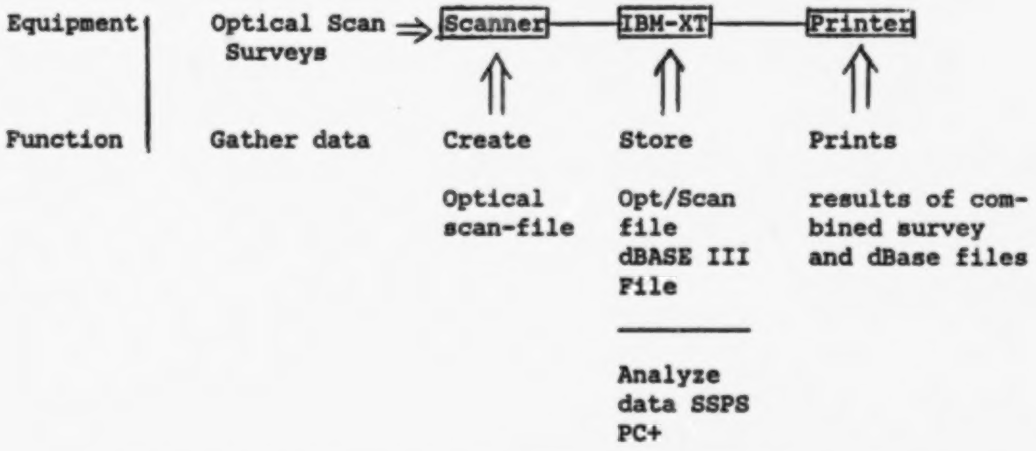
IV. Demographics and dBase III

The SPSS PC+ statistical package was used to analyze the data. SPSS can read an ASCII data file and transform the information into an SPSS systems file. Since the file created in dBASE III are not ASCIII file, it must be converted to meet this requirement. To accomplish this, only one command needs to be issued after all data has been entered and the demographic file accessed. A command to convert a dBASE III file to an ASCII file would look like this: **Copy to (File Name) SDF** Utilizing this command, both the dBASE file and the new ASCII file are available to the researcher. Again, once this step is completed, the SPSS PC+ program is able to transform the demographic data into a useable SPSS systems file.

Before discussion begins related to SPSS PC+ package, several points should be noted. First, it is critical that the researcher take a "macro" rather than a "micro" view of his/her research endeavors, especially as it pertains to PC hardware and software. Benefits found with this advance computer technology will have little if any positive effect if various programs and systems are not viewed as an integrated package. For example, unless the demographic data from the dBASE III file could be accessed by SPSS, it would not have made sense to spend the extra time and effort retrieving this information. Likewise, it behooves the researcher to know (or to find out) that a data file created by the optical scanner can facilitate not only data gathering activities but also alleviate some of the drudgery associated with creating a useable data file. Such a file must be compatible to a statistical program and should lend itself to various analysis. Configuration of the system used at HACC and integration of the software packages can be found in **Figure** 1.

Figure 1

Configuration/Integration of HACC'S Hardware and Software



While the optical scanner and dBASE software have greatly enhanced and expanded the ability of the Research Office to conduct a wide array of survey projects, it must be emphasized that knowledge of both software and hardware is a prerequisite for any successful endeavor. Just as one should not acquire a hodgepodge of PC hardware and software without regards to the task at hand, time, effort, and even money spent on gaining and improving one's computer knowledge (both hardware and software) can be readily translated to more productive and efficient operation. While the initial outlay for equipment and training may cause one to question the value of applying this new technology, once the system is established, most find that the return more than justifies the outlay.

Some examples of cost would include a data base file which may run from $300-$600 (dBASE III cost $395) while a statistical package could be in the $600-$1000 range (SSPS PC+ cost $795). Workshops, training sessions and formal classroom instruction expenses varies greatly depending upon the needs and background of the researcher. An excellent two-day workshop for SSPS PC+ beginners was available for

$475. Finally, obtaining a PC system usually proves to be the largest single expense but also one of the most flexible given the quanitity and quality hardware now available. The IBM XT system employed at HACC (with printer & monitor) ran about $2500.

With the proliferation of application software programs and computer hardware equipment, it should be emphasized that no one program or PC is ideal for all institutions or for every project. Similar to establishing the configuration for one's hardware requirements, software selection should be chosen to match <u>both</u> present and anticipated future needs plus conforming to hardware specifications. For the creation of the demographic file, other packages such as Lotus 1 2 3 and SPSS Data Entry could have also easily accomplished the same task.

V. Data Analysis Using SPSS PC+

Once the data files have been established, the analysis portion of the project can begin. To do this, the Research Office at HACC employed the SPSS PC+ program. As mentioned earlier, other statistical packages (e.g. SAS) are available and consideration should be given to the one which best fits one's institutional needs.

Gaining a working knowledge of SPSS PC+ came primarily through trial and error. As mentioned earlier, SSPS Inc. offers a large number of workshops and training sessions. Also, since SPSS is one of the most common statistics packages, many educational institutions offer courses using this program. Again, resources expended to gain a working knowledge of SPSS or any other statistics program is quickly recovered many times over in terms of quality and productivity.

Returning to the data files, only one can be transformed to a SPSS system file at a time. Using the demographic file constructed with dBASE III, the first steps require identifying the proper ASCII file and then defining the data. Using the file name Grad.87, the data is retrieved and is now ready for further definition. The following directs SPSS to where the data can be located:

```
Data list file = 'Grad.87'
```

This command informs SPSS that the data used to create the new SPSS systems file can be found under the name of ASCII file GRAD.87. Next a name and column location is assigned for each variable within the "data list" command. For purpose of ease, sex, age, race, curriculum (academic major), and GPA have been selected as the variables and are thus named.

Besides naming the variables, column location in the data file must be specified. In our dBASE file, the sex variable was found in column one, age in 2-3, race in 4, curr. in 5-7, and GPA in 8-10. Each variable in SPSS must also be identified using the <u>same</u> column(s).

Since this is a continuation of the data list definitions command, the following describes the five variables:

```
Data list File = 'Grad.87'/Sex 1  Age 2-3  Race 4  Curr 5-7
GPA 8-10 (2)
```

The above command named each variable in our data file, gave the column locations, and indicates all decimals in parenthesis (e.g. GPA = 2.78). The back slash tells SPSS to begin defining the variables.

Besides identifying each variable, SPSS allows the assignment of both variable labels and value labels. Variable labels are used to provide an "extended" description of the variables and using them is optional. Conversely, value labels generally are more important because they assign descriptive labels to each value. For example, if the numbers one and two are assigned to the "sex" variable, the value label will show whether the number one is coded for a male or a female. Both the variable and value labels are designed to enhance the readability of the output. It should be noted that some variables, such as "age", requires no further explanation. Use of these labels can be seen in the following:

```
Variable labels curr 'Academic Major'.
Value labels Sex 1 'Male'  2 'Female'/Race 1 'Blk'  2 'Hisp'
3 'AI'  4 'As'  5 'Wh'/Curr 1 'Bus'  2 'Arts'  3 'Sci'
4 'Engin'  5 'Social Sci'.
```

Upon completing all required variable definitions, the data can now be saved as an SPSS systems file. The SPSS package does allow one to alter the value of or create new variables with existing ones through the "compute" and "recode" commands. This data transfiguration is especially valuable when a variable contains many values (such as AGE) and regrouping would significantly improve the reporting function. For example, it is far easier to say people in their 30's are attending school in record number versus citing a specific number for each year for those 30-39 years old. To recode and label a variable in our example, the following commands can be used:

```
Compute Agegrp=Age.
Recode Agegrp (Low thru 22=1) (23thru29=2) (30thru39=3)
(40thruhi=4).
Value label Agegrp 1 'LE22yrs' 2 '23-29yrs' 3 '30-39yrs' 4
'GE40yrs'.
```

Since we have two different files of data, similar commands related to defining the optical scanner file are needed. Before definition of the second file can be concluded, the first file should be saved by issuing the following:

```
Save Outfile = 'Gradsur.87'.
```

Note the change in the file name as we now have both an ASCII file (from our dBASE III) and a systems file for SPSS. After defining the data in the second file and the saving it, both files can be merged or joined together as one. To accomplish this, one of the systems file is read into SPSS and then the **"join match"** command is issued. These commands would appear as follows:

```
Get File = 'Optical.Scn'.
Join Match File = 'GRADSUR.87'/File = *.
Save Outfile = 'SURVEY.87'.
```

In the example, we first read one of the systems file into the SPSS program (called 'Optical.Scn' from optical scan data file) and then "joined" the second system file (**Gradsur.87**) with the active (or first) file. The final step requires saving the "new" file (after both systems files have been "joined" and "matched") by again employing the **"save"** command. The new (or third) SPSS systems file is now ready for the appropriate analysis to be conducted.

For most researchers, especially those in a modest size research office, the type of statistics available in a basic statistical package usually is sufficient to complete many if not all project requirements. This, of course, doesn't preclude the addition of more advanced statistics as is warranted but many have found that upper level administrators and most "non-statistically" oriented people begin to feel lost and uncomfortable once data move much beyond the simple mean, median, correlation, or chi square threshold. Some of the commonly used data analysis commands found in SPSS PC+ are:

ANOVA, Correlation, Crosstabs, Frequencies, List, Means, Oneway, Regression, Sort, and T-test.

Any one or a number of analyses can be used but planning again is the key. As with all reports, a researcher should have a general idea of the material he/she is reporting on and a plan to complete the required analysis. While worthwhile and even valuable results have been uncovered through random analysis, accepted practice and practicality generally sway most from this course. Also, with only a few variables and SPSS commands, any researcher could easily be inundated with print-outs and results far beyond one's capacity to effectively digest and use.

Some of the most common analysis can be accomplished simply by issuing a set of commands. SPSS allows the researcher to select from a number of options and statistics with each command so this means that familiarity with these features can only enhance one's understanding of the data. The crosstabs command below illustrates some of the options available:

```
Crosstabs  Sex  Race by Curr  Quality/
Option = 3 4/
Statistics = 1.
```

This commands SPSS to crosstab "sex" by the "academic major" (curr) and "program quality" variables and repeats the same procedure for "race". Option 3 and 4 tells SPSS to produce row and column percentages for each cell while the statistics command will produce the chi square results. Again, many commands are available and it behooves the researcher to commit sufficient resources and time to master this data analysis package.

To produce a hardcopy of the results, the printer can be activated by using the "set" command as shown: **Set Printer = On.** Once the statistics analysis is completed then the reporting function comes into play. SPSS does provide a well documented reference text with their package plus many others are also available (Norusis, 1986).

VI. Discussion

Institutional research offices employing only a small staff or a single person can now be far more productive than ever before due to the advances achieved in both PC computer hardware and software. The examples citing the optical scan format, dBASE III, and SPSS PC+ was not meant to be a comprehensive or even an introductory lesson in these or any other similar type packages. Rather, the critical lesson which this paper attempted to convey is the enormous benefits these application software programs and innovative hardware equipment can play in expanding the research dimension of any modest or small office.

A review of the optical scan format, dBASE III, and SPSS PC+ was presented in a cursory fashion. Each step needed to create and analyze the data files involved far more details than those discussed. Yet, even with this terse coverage, the material discussed provides a solid framework for any researcher to begin investigating and perhaps incorporating these changes in his/her work environment.

In summary, this paper suggests that to harness the technological innovations now accessible to small research offices, these points are critical:

1) <u>Planning is vital</u>. A researcher must determine needs of office and institution, the resources available, and the required hardware and software to best meet expectation and demands.

2) There is an initial cost, sometimes relatively high. This includes not only cost for hardware and software but also for training required to fully utilize the new technology. However, the results of incorporating these innovations can lead to a more efficient and effective research office and staff.

3) Ask questions and learn from others. Professional colleagues, computer specialists, and administrators are a source of expertise and experience. For many, seeking out and exchanging/sharing ideas is a valuable avenue to plan for and enhancing the work of any IR Office.

4) Make the committment to improve and change and dare to be different. Far too often the decision to do something new is the most difficult step but once taken a new world of possibilities and opportunities opens.

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ANALYZING, INTERPRETING, AND REPORTING ASQ DATA

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INTRODUCTION

The College Board's Admitted Student Questionnaire (ASQ) is designed to elicit from students admitted to a given college what factors may have been instrumental in their decision whether or not to enroll in that college. Subscribers to the service receive two reports on their questionnaire data. The Detailed Report gives frequency distributions for all the multiple-choice questions on the survey, while the Highlights Report presents some preliminary analyses of the data.

For an optional fee, users can purchase the data file of their survey responses. With this file in hand there is a wealth of information to be gleaned from the ASQ. The purpose of this paper is to illustrate ways to use the data file to go beyond the analyses given in the Highlights Report: 1) to examine questions that might be asked of the data; 2) to identify population subgroups of interest; 3) to suggest some relationships among survey questions; 4) to demonstrate analytical approaches using SPSSX; and 5) to offer some samples of effective presentation of the data, using in particular Lotus 1-2-3 and Harvard Presentation Graphics.

1. RESEARCH QUESTIONS

Part II of the User Manual that accompanies the Detailed and Highlights reports suggests some questions that can be answered from the data presented in those two reports, without using the data file. Such questions might include: "Are we losing the students to whom particular characteristics of a college are important? Are we especially attractive to students who value particular characteristics?" (College Board, 1989a, p. 9). Here the Manual suggests examining the yield rate (the percentage of students making a given response who enroll) associated with each of the characteristics considered very important by a large percentage of the respondents. "A high yield suggests that you are attractive to students who value this characteristic; a low yield suggests the opposite" (loc. cit.).

In interpreting the yield rates for the different survey questions it is important to bear in mind the overall yield rate, i.e., the percentage of the total number surveyed who enroll. If the college has surveyed all its admitted students, this is the same as the overall admissions yield. However, if the college has only surveyed a sample of its admitted students, and if the Enrolling and Not Enrolling students were not sampled in equal proportions, the survey yield rate should not be interpreted in the same way as an admissions yield. For example, if a college surveyed 500 Enrolling and 500 Not Enrolling students, the overall yield rate shown in the survey would be 50%. If, however, the college had actually admitted 2000 students, of whom 500 enroll, the admissions yield rate would actually be 25%. Thus the yield rates of interest in the ASQ reports are those which are large relative to the overall yield rate for the survey, rather than those which are simply numerically large.

Table 1 compares the response percentages and yield rates for students indicating that particular opinions were Very Important (these data are taken from the Norms Report, 1989, using data from all 1988 participants in the survey). This table indicates that all respondents were much more likely to consider the opinions of their parents, potential employers, and graduate/ professional schools to be very important, than to consider the opinions of a guidance counselor, high school teachers, or their friends to be so. In addition, the yield rate for students rating any of these opinions very important

Table 1
RATINGS OF OPINIONS AS VERY IMPORTANT
Response Percentages and Yield Rates

	RESPONSE PERCENTAGES FOR ALL ADMITTED STUDENTS						YIELD (% WITH GIVEN RESPONSE THAT ENROLLED)					
	TOTAL %	Research Doctoral %	Compre-hensive %	Research Doctoral %	Compre-hensive %	Liberal Arts %	TOTAL %	Research Doctoral %	Compre-hensive %	Reserach Doctoral %	Compre-hensive %	Liberal Arts %
OVERALL YIELD							42	47	46	45	40	38
Parents	61	61	63	58	65	60	43	47	48	47	41	40
Guidance counselor	17	18	21	15	17	16	46	50	53	46	43	41
High school teachers	14	14	17	13	14	14	48	50	56	50	46	44
Friends	18	23	27	15	18	14	49	52	54	50	46	45
Potential employers	52	56	57	52	55	46	44	47	48	48	42	41
Graduate/professional schools	53	51	45	60	53	52	43	46	46	47	41	40

Data taken from The College Board, Admitted Student Questionnaire Norms Report: 1988 ASQ Participants. Comparative Profile -- All Institutions, 1989.

was generally higher than the overall yield rate for all admitted students.

Notice, however, that while parents' opinion of the college, for example, was very important to more than half the respondents, that opinion was not particularly associated with yield. That is, students considering their parents' opinion to be very important were not more likely to enroll than students who considered their parents' opinion only somewhat or not important. Notice also that while the yield rate for those considering a guidance counselor's opinion very important was third highest (in absolute terms) for students admitted to private research doctoral institutions, it was lowest in relative terms, being only 1% higher than the yield rate for all admitted students in that category. In contrast, the yield rate for students admitted to public comprehensive universities who considered a guidance counselor's opinion very important was 7% higher than the rate for all respondents in the public comprehensive group.

2. POPULATION SUBGROUPS

Part III of the User Manual suggests some subgroups that may be of interest to the user of the ASQ, e.g., subgroups based on gender, high school grades or test scores, race/ethnicity, or family income (College Board, 1989b, p. 4). Subgroup analysis is one of the most valuable uses of the data file. One might ask, for example: What images of our institution are held by enrolling and not enrolling students of high ability? Do students of different racial/ethnic groups consider different college characteristics to be very important? How important are costs and financial aid to students of varying ability, race/ethnicity, etc.? How important are no-need awards to students of high ability? Do out-of-state students compare us to a different set of institutions than do in-state students?

Figure 1 compares the percentage of Black and Hispanic Enrolling and not Enrolling students exposed to various sources of information about one institution. Some striking differences between Black and Hispanic groups are apparent from this figure. Not Enrolling Hispanic students were much less likely to have had contact with the college after they were admitted than were Hispanic students who planned to enroll there; in contrast, about 90% of both groups of Black students had had some post-admission contact. Among Hispanic students, a visit to the college occurred almost as often among Not Enrolling as among the Enrolling students; Not Enrolling Black students, however, were much less likely than their Enrolling counterparts to have visited the campus. Thus, yield seems to be more strongly associated with post-admission contact for Hispanic students, but with campus visit for Black respondents.

Table 2 compares Black and Hispanic students on their images of one large university. The perceptions held by Hispanic students were particularly interesting to those concerned with increasing the number of Hispanic students enrolled. The Admissions staff explained these students' image of the University as supportive in terms of the recruiting efforts made to attract Hispanic students: making high school presentations in Spanish, meeting with the parents of Hispanic high school students, sending out eighth-grade college preparation guides in Spanish, etc. Once the students enrolled, however, almost everything they heard and read was in English. In addition, there were relatively few efforts made by the University to help the students feel comfortable with the non-Hispanic environment, on the one hand, and to underwrite the efforts of Hispanic student organizations on the other, all of which contributed to a disappointing retention rate among Hispanics.

3. RELATING SURVEY QUESTIONS TO EACH OTHER

One of the most useful ways of relating survey variables is to look at the ratings of college characteristics in terms of the importance of those characteristics to the students. When the variables (e.g., Quality of faculty, Variety of courses) are very important to a large percentage of both enrolling and not enrolling students, the comparative rating may be more strongly associated with yield than is the importance of the characteristic. Some of the graphs presented in the Highlights report may indicate those variables for which importance is a more influential factor in the yield, as well as those for which

Figure 1

EXPOSURE TO SOURCES OF INFORMATION
BLACK and HISPANIC Students

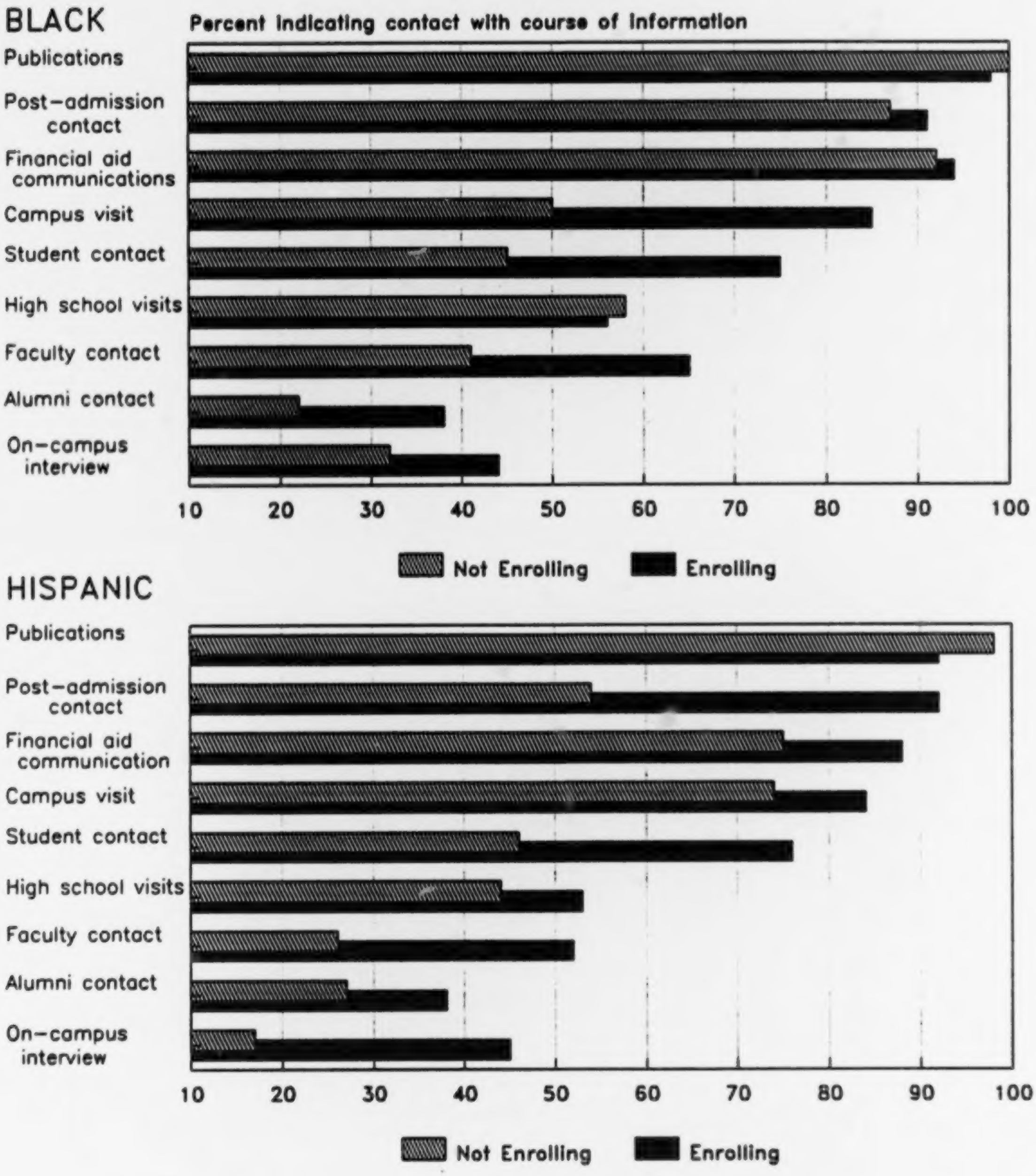


Table 2
RACIAL/ETHNIC DIFFERENCES IN COLLEGE IMAGES

BLACK respondents are the group most likely to think of the University in terms of academics. They are the Enrolling group:

Most likely to mark:		Least likely to mark:	
Challenging	(73%)	Back-up school	(6%)
Career-oriented	(66%)		
Prestigious	(66%)		
Liberal	(49%)		

and among the most likely to see it as:

Intellectual	(48%)

Not Enrolling Black students are:

Most likely to mark:		Least likely to mark:	
Comfortable	(44%)	Back-up school	(33%)
Partying	(41%)	Prestigious	(11%)
Liberal	(33%)	Exciting	(0%)
Intellectual	(22%)		

HISPANIC students tend to see the University in terms of supportiveness and social life. They are the Enrolling group:

Most likely to mark:	
Social	(76%)
Comfortable	(60%)
Friendly	(60%)
Exciting	(56%)
Fun	(54%)
Partying	(52%)
Relaxed	(46%)

and are also likely to see the University as:

Challenging	(72%)
Intellectual	(48%)

Not Enrolling Hispanic students also see the University in terms of supportiveness and social life, but somewhat more negatively than do the Hispanics who enroll. They are the Not Enrolling group:

Most likely to mark:		Least likely to mark:	
Fun	(38%)	Partying	(38%)
Relaxed	(38%)	Social	(38%)
Liberal	(33%)	Career-oriented	(19%)
Impersonal	(29%)		
Exciting	(24%)		
Prestigious	(24%)		

yield is more strongly related to the college's relative performance on it. The report may also identify characteristics for which there is an interaction between importance and rating.

From a marketing perspective, it is informative to determine how exposure to different sources of information about the college affects the respondents' ratings of the college. For example, does contact with faculty members have an effect on how the respondents rate the college on Quality of faculty or Access to faculty? One university found that enrolling students who had had contact with faculty were less likely to consider that university to be to be a Back-up school than were respondents who had had no contact with faculty, while Enrolling respondents who had had contact with current students were more likely to see the college as a Back-up school (Figure 2).

Figure 3 indicates that a visit to the campus had a positive effect on the Not Enrolling respondents' ratings of some of the college characteristics. For Enrolling respondents, however, the campus visit only affected the rating of the Quality of faculty. Does this graph imply that applicants should be encouraged to visit the campus because doing so will improve their opinion of the college? Or, alternatively, does it imply that applicants visit the campus because they are already favorably disposed toward the college? The truth is probably a combination of both explanations and the Admissions Office has to consider the implications thereof.

4. USING SPSSX

The data file that colleges may purchase includes an SPSSX program file containing the record layout and labels for all the survey variables. Users may expand this file to perform many analyses, including factor analyses, multiple regression, discriminant function, and loglinear analyses. Multiple response analysis can be used to study the respondents' "choice sets"-- the set of other institutions to which the students applied or were admitted.

Table 3 displays part of the "choice sets" (the set of other colleges to which the students were admitted) of one college's Enrolling and Not Enrolling students of high academic ability. While the Enrolling and Not Enrolling lists have many colleges in common, it is interesting that the institution at the top of the list for Not Enrolling students--Cornell--did not make the Top 20 list at all for Enrolling students. Table 4, comparing the "Win percentage"[1] of various colleges, indicates that students admitted both to this college and to Cornell are much more likely to choose to attend Cornell.

When colleges have added their own identification code to the survey the data file can also be matched to other institutional files. Additional admissions information could be used to identify other subgroups of interest, for example students from particular high schools or those intending to major in a particular field. Subsequently, one could examine the retention rates of students to whom particular characteristics were important, or who rated the college high (or low) on a given characteristic. SPSSX could also be used to analyze any comments or "other" responses students may add to their survey.

5. EFFECTIVE PRESENTATION OF ASQ DATA

Because of the amount of information available from the ASQ, the most effective presentation of data beyond that available in the Highlights Report may depend on such factors as the interests of the audience or the format of the presentation (oral vs. written). A narrative format might be used in a series of short papers on various topics from the survey, e.g. images, choice sets, or financial aid. Bullet charts can highlight important differences between groups, and add punch to an oral presentation. Tables are a valuable way to convey a lot of information, such as comparison of subgroups on a lot of variables, but graphs and charts may make it easier to identify trends that can be obscured by

---

[1] Win percentage: of the students enrolling at either "our" college or another specific college, the percentage choosing to enroll at our college.

Figure 2

Effect of Contact with Faculty & Students on Image as Back-Up

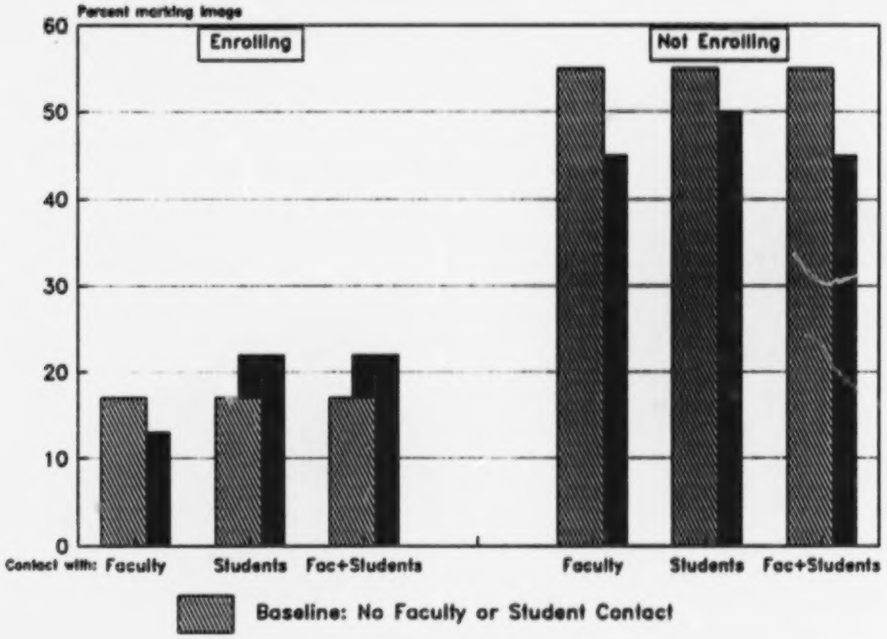
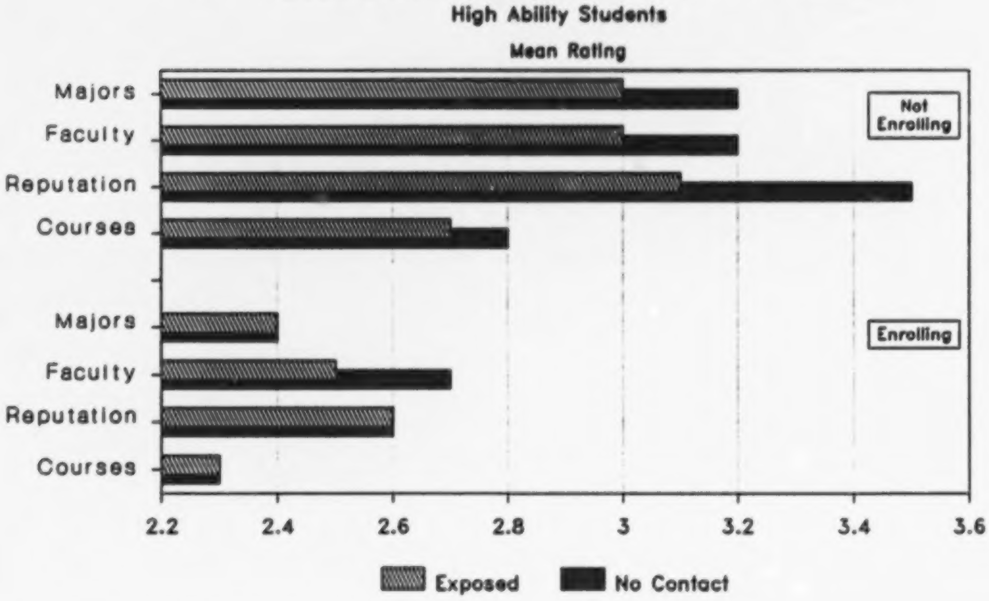


Figure 3

Effect of CAMPUS VISIT on Ratings of Selected Characteristics



Scale: 1=Best 2=Better than most 3=About the same 4=Poorer than most 5=Worst

Table 3

"CHOICE SETS": COLLEGE ALTERNATIVES
Enrolling and Not Enrolling Students of High Ability

COLLEGES ADMITTED TO

Enrolling	N	%	Not Enrolling	N	%
Penn State	70	17.3	Cornell	148	13.0
Boston Univ.	41	10.1	Lehigh	138	12.2
Delaware	38	9.4	U. Pennsylvania	116	10.2
Lehigh	31	7.6	Boston Univ.	114	10.1
SUNY-Binghamton	23	5.8	Penn State	101	8.8
U. Massachusetts	23	5.8	Delaware	82	7.2
Trenton State	22	5.5	Carnegie-Mellon	71	6.2
U. Maryland	21	5.2	U. Michigan	71	6.2
Lafayette	19	4.6	Bucknell	70	6.2
Drexel	16	4.1	Johns Hopkins	68	6.0
Geo. Wash. U.	16	4.1	SUNY-Binghamton	65	5.7
NJ Inst. Techn.	16	4.1	RPI	65	5.7
Stevens Inst.	16	4.1	Columbia U.	64	5.7
Carnegie-Mellon	15	3.6	Villanova	59	5.2
RPI	15	3.6	Duke	55	4.8
Syracuse	14	3.4	Lafayette	54	4.8
Temple	14	3.4	U. Massachusetts	52	4.6
VPI	14	3.4	Princeton	51	4.5
Brandeis	12	3.0	VPI	51	4.5
Villanova	12	3.0	Rochester	46	4.0

Table 4

"WIN" PERCENTAGE: HIGH ABILITY VS. TOTAL RESPONDENTS

	High Ability		Total	
COLLEGE X	N Admitted	"Win" %*	N admitted	"Win"%*
Penn State	166	85.4	381	86.8
Lehigh	161	50.8	213	54.1
Cornell	147	12.8	161	14.0
Boston Univ.	142	66.1	255	63.2
U. Pennsylvania	117	10.6	131	15.5
Delaware	116	61.3	285	63.4
SUNY-Binghamton	84	62.2	156	56.4
Carnegie-Mellon	78	50.0	98	50.0
U. Michigan	78	20.6	88	27.0
Bucknell	76	34.5	97	32.4
RPI	76	42.9	91	47.6
U. Massachusetts	75	57.5	167	55.3
Lafayette	73	57.6	96	52.4
Johns Hopkins	72	35.5	77	33.3
Villanova	71	41.4	142	39.0
Columbia	66	5.3	70	5.1
New York Univ.	58	51.6	123	47.4
Trenton State	54	59.5	151	66.4

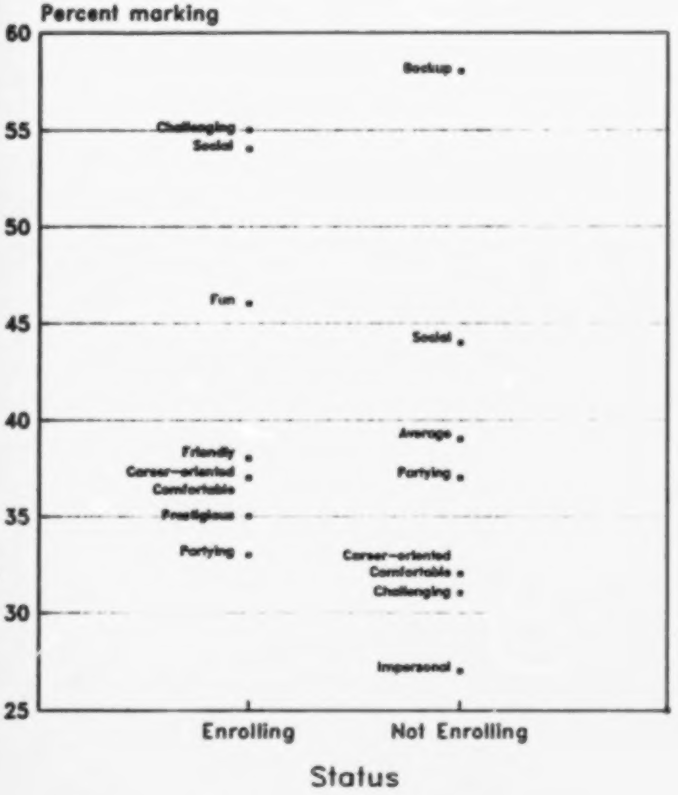
* "Win" percentage: Of the total attending either this college or College X, the percent attending this college.

Note: All N's are weighted. "High ability" is defined as students with a total SAT of 1250 or more, OR an SATV of 600 or more, OR an SATM of 650 or more.

Figure 4

GRAPHIC VS. TABULAR PRESENTATION OF DATA: COLLEGE IMAGES

Enrolling and Not Enrolling Students of High Ability



Eight most frequently marked images for each group

	% Marking Image
ENROLLING STUDENTS	
Challenging	55
Social	54
Fun	46
Friendly	38
Career-oriented	37
Comfortable	37
Prestigious	35
Partying	33
NOT ENROLLING STUDENTS	
Back-up school	58
Social	44
Average	39
Partying	37
Career-oriented	32
Comfortable	32
Challenging	31
Impersonal	27

the myriad numbers in a table. Graphic data may also be more useful in an oral presentation.

Figure 4 shows two different ways of presenting the same information. The actual percentages are easier to find in the table, but the graph presents the data more dramatically. Staff members at this college, which is interested in earning a reputation as an institution of high academic quality, were somewhat dismayed to see that its primary image among Not Enrolling students was as a Back-up school, and that Enrolling and Not Enrolling students perceived the college very differently.

SUMMARY

The Admitted Student Questionnaire is a very useful tool for learning what factors are important to students in their college choice decisions. While the Highlights and Detailed reports provide valuable information on and analyses of the differences between Enrolling and Not Enrolling students, a closer examination of an institution's data file can yield a wealth of information on subgroups and on relationships between the factors studied. In fact, it is often necessary to be very selective in what data are presented to particular audiences, so that the reader (or audience) does not become overwhelmed by the amount of information available. In general, however, analyzing a college's own data file is well worth the effort expended.

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Diffusing Technology Through the the Institutional Research Office: Survey the Market First!

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It will often be the case that introduction of new technology in an institution affects the users of information which is typically the product of an institutional research office as much as, if not more than, the practitioners of institutional research. This is a general problem that any institutional researcher will face who tries to take on the challenge of implementing new technology. In this presentation I will discuss two cases where attempts were made to enhance the technological capabilities of an institution, and the effects of these efforts on the institutional research office of the institution. I will then outline a market research approach which is intended to avoid some of the problems illustrated by the two cases.

Institution A is a small, four-year college which decided to upgrade the software for its administrative computer users. It had been decided by the senior administrators of the institution, with approval of the board, that an integrated software package for administrative computing was needed. Such a software package provides modules for a variety of administrative offices, including the registrar's office, admissions, financial aid, the alumni office, and the finance office.

In this case, selecting the particular software and appropriate hardware was made the responsibility of a committee chaired by the director for administrative computing. Three offices: admissions, the alumni office and the finance office, were heavily involved in the selection process. Coincidentally, the directors of the admissions and alumni offices are two of the senior administrators who were responsible for making the decision, and the vice-president for business affairs was a third. Other offices, such as the registrar's office, financial aid and institutional research were not directly involved in the decision to purchase a new software package and consequently came late into the selection process.

While there are always problems involved with any improvement in the technological capability of an institution, certain problems arose in this case which could have been avoided if all of the intended users were somehow involved in the selection process. For example, the financial aid office has historically used a stand-alone system, with software designed specifically for its use. While the idea of integrating the data generated by this office with the data generated by other offices was an important reason given for upgrading the administrative software, there is skepticism on the part of this office whether the financial aid module for the integrated package will completely replace its stand-alone system.

Apparently, since none of the packages under consideration included a module specifically designed for use by an institutional research office, the leaders of the project neglected to include this office in the decision or selection process. This is likely a function of the limited role traditionally played by the institutional research office in that institution. Unfortunately, as a result of being excluded, the institutional research office must "make do" with the results of a decision which has a substantial effect on institutional research.

At institution B, a small, comprehensive college, the institutional research office is intimately involved in drafting a grant proposal to seek funding for an institutional data center to support the planning process at the institution. The data center is intended to provide data to senior administrators, academic unit administrators, academic departments and various committees involved in planning at the institution. The proposal includes purchase of computer equipment in order to provide those who would use the data center with the ability to analyze data to obtain planning information. The intent is to avoid the production of paper documents which do not always provide the information needed to plan in an environment that is bound to undergo rapid change.

At this institution, the institutional research office has historically been linked with administrative computing, and has recently been redefined to support planning at the institution. Unlike the case of institution A, the institutional research office at institution B has been involved in the decision process from the very beginning. While this avoids one of the problems mentioned in the discussion of the first case, this case has its own problems.

While the grant proposal seemed like a good idea, it was rejected by the funding agency. The main reason cited for the rejection was that the proposal did not provide any evidence that the data center would be used by its intended users. As a matter of fact, the proposal was authored by two senior administrators and the director of institutional research. The criticism is a fair one, and can also be applied to the initial stages of the decision process at institution A.

Both cases, then, suffer from the fact that they lack input from those who are most likely to use the new technology or its products. As a solution to this kind of problem, I will present a market research approach that is intended to incorporate the effect on the user of a new technology into the decision to provide the technology.

Unlike typical market research, where it is important to determine an advertising or promotion strategy that will best sell the product in a specific market, the approach advocated here does not seek to match the message to the market, but to determine whether a specific technology is well-suited to the information needs of a given market.

Robert Sevier (1) identifies three steps in market research:

1. develop research questions based on an analysis of market data

2. develop and execute a research strategy

3. convert market research data into information upon which to base a marketing decision

The process described below is not intended to result in a marketing decision as Sevier describes it, where the decision is a choice among different advertising or promotion strategies. Instead, the intended outcome of the market research is to match the initially vague concept of a new technology with the perhaps not fully articulated needs of the intended users of the technology. It is assumed that if the proposal is specified so that it matches the needs of the user, the transaction (the introduction of new technology) will thereby succeed.

Given the special characteristics of this type of market research, the emphasis in this approach is on the process of making a vague proposal into a specific description of a kind of technology, and on determining the relevant needs of the targeted users for this type (or some type) of technology.

The first step in the market research approach is to specifically identify the product that is to be "marketed." It is crucial to exactly specify what you plan to market. In particular, spell out the consequences to the user of the proposed technology. Implementing new technology becomes difficult when you do not determine how the user is likely to respond to the product, and especially to the consequences of buying into the technology.

The first step is primarily conceptual. The next step must take into account how this idea will be made concrete. In this step, research should be done to identify the range of technologies available to implement the proposal. In order to avoid the kinds of problems illustrated in the two examples above, the user's response to the product is important. Successful diffusion of technology depends more on the user's likely response to the actual product than on the user's reaction to the concept of a new technology. Here, too, it helps to have specific information about how the concept will be realized. In the case of institution A cited above, some effort was made to determine user response to the technology by inviting software vendors to the campus so that the staff of the affected administrative offices could see how the software worked.

At institution B, two new micro-computers would be available in a library-type setting adjacent to the institutional research office. However, failure to specify the software support made it difficult to describe the format in which planning information would be made available. This consequently made it difficult for potential users to respond to questions about the likelihood that they would use the new technology.

The first two steps serve to specify the product. The third step is to specify the users. Presumably there is some group on campus who will be affected by the proposal. Identify them so they may be surveyed to determine their likely response to the product. At institution A, potential users were identified by the existence of a module for their kind of office. As was mentioned, this process failed to identify the institutional research office as a potential user of the new technology. At institution B, potential users were identified by means of the kind of information produced.

The survey of the potential users is the fourth step of a market research approach. The purpose of the survey is not only to determine the likely response to the product, but should also uncover responses that suggest certain modifications to the product. The survey may also have a more subtle effect. By implicitly announcing an intention to introduce new technology, you may be able to motivate support for the proposal.

At institution A, a kind of survey of the potential users was achieved by inviting those who had attended a demonstration to provide any comments to the committee responsible for the software.

In a similar situation, where a choice is to be made among alternative systems, William Blanchard, George A. Pierce and Shelia M. Hood describe the application of multicriteria analysis to the evaluation of three different proposals to meet the student information requirements at their institution (2). This is one example of the use of a specific survey technique as part of a process to implement new technology. At institution B, the issue was not to decide among competing alternatives, but to determine whether there would be an adequate level of use to justify the expense of new technology.

In this case, preliminary discussions with selected academic administrators and members of a long-range planning committee indicate that there are major obstacles which stand in the way of delivering planning information as described in the grant proposal. Only one administrator interviewed is currently comfortable with the kind of hardware and software recommended in the proposal, and all indicated an unwillingness to go out of their offices to gain access to the data. A different obstacle was identified by members of the planning committee, where it was made clear that there was disagreement about the kind of data to be maintained by the data center to support planning.

The market research approach outlined above provides a means for addressing the issue of how proposed institutional research technology will affect the users of institutional research information. It also has two additional benefits:

1. By researching the available technology, the institutional researcher may discover institutional research technologies that better fit the concept.
2. By surveying the potential users, the institutional researcher not only avoids implementing a proposal that fails for lack of user support, but may also discover ways to modify the proposal that would make it more "marketable."

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Comparing the Earnings of Graduates and Withdrawals from an Urban Institute of Technology

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Higher education today is typically a joint financial effort, paid for by both individuals attending college and by society. This investment is hardly an altruistic endeavor; individuals and society each expend resources in hopes of some reward. For the general population, these benefits are very well known (Taubman and Wales, 1974; Bowen, 1977; Leslie and Brinkman, 1986). In addition to such intangibles as a broadened perspective and an increased range of interests, college graduates are employed more often, have better jobs, and earn higher salaries (Bureau of the Census, 1987). Society also benefits; in addition to being more enlightened generally, the community receives more tax dollars from college graduates and thus increase support for government services. Follow-up of alumni provides colleges and universities with intelligence concerning these benefits. In turn this information can be used, along with other data, in marketing to potential students, justifying maintenance of programs, supporting development efforts, and motivating students to remain in college.

Most institutions follow-up on their graduates using mail or telephone surveys. However, these methods are subject to at least two limiting conditions. First, the data are self reported, and thus open to response bias. Second data are available only for those who choose to respond; no data can be collected on those who choose not to respond, or those graduates of unknown address. For the purposes of control it is often desirable to compare graduates of an institution with individuals who have attended but have not graduated. Follow-up of withdrawals is difficult because these individuals have little motivation to support the efforts of such inquires. Yet information from such a group is critical in evaluating the effects of completing degree requirements.

The purpose of this paper is to report on the results of a study using data provided by the U.S. Internal Revenue Service concerning the earnings of alumni of the Rochester Institute of Technology. The intent is to focus more on the methodologies and implications of using such administrative data than on the generalizability of the results.

METHOD

Sample

After lengthy negotiations between Rochester Institute of Technology's National Technical Institute for the Deaf and the Statistics of Income Division of the Internal Revenue Service (IRS) an agreement was reached whereby the IRS would, under a reimbursable contract, provide earnings analysis for alumni–both graduates and withdrawals. This collaboration has the benefit of not depending on self reporting of information, being non-intrusive, and being able to assess the earnings of 100 percent of the population under study.

A computer tape, containing the Social Security Numbers of 11,935 individuals who had attended and exited the Rochester Institute of Technology between September 1, 1978 and August 31, 1984, was sent to the IRS.

In addition to social security number, the computer tape included the variables of entry status, degree attained, year of graduation, and academic major. These attributes were the independent variables by which the IRS provided summary tabular information (numbers of persons, means, standard deviations, kurtosis, and skewness) for wages and salaries as reported on 1985 W-2 statement. Table 1 provides a sample of the way data was transmitted by the IRS to researchers at RIT.

IRS procedures for safeguarding the confidentiality of data about individuals are stringent. The type of information provided by the IRS is grouped data only, and regulated by their Disclosure Litigation Division. Any cell containing fewer than three cases was suppressed, making identification of individuals impossible.

TABLE 1. Sample Data Provided by the IRS for use in this study.

Status[1]	Degree[2]	Frequency	Mean	Std Dev	Kurtosis	Skewness
1	1	3336	12,966	12,134	8.0	1.8
1	2	3255	21,506	13,129	3.4	.7
2	1	1791	16,284	14,121	59.7	3.9
2	2	3553	23,426	15,522	91.7	4.7

[1] Freshman = 1, Transfer = 2.
[2] Withdrawn = 1, Bachelor = 2.

The reported earnings are of W-2 wages and salaries only, and do not include income from self-employment, rental property, interest on investments, and other such remunerations. Additionally, these data did not permit a distinction between full-time and part-time workers and did not identify those who were unemployed for part of 1985. Since total *income* often exceeds wages and salaries – mean earnings of full-time year-round workers are higher as a group than the means for all workers – *figures presented in this paper are probably very conservative.*

Analyses

Data provided by the IRS permitted researchers at RIT to analyze earnings according to degree level, major area of study and length of time from graduation. All these analysis provided information useful in recruiting students and in counseling students who are considering withdrawing from college.

Another area of interest concerns comparison of earnings of RIT alumni with national normative statistics. For this purpose statistics published by the Bureau of the Census 1987) were used to compare the earnings of RIT alumni with a national sample of 25 to 34 year olds who had comparable educations. Comparisons were as follows: withdrawals were compared to individuals who completed four years of high school and bachelor graduates were compared with individuals who completed four years of college.

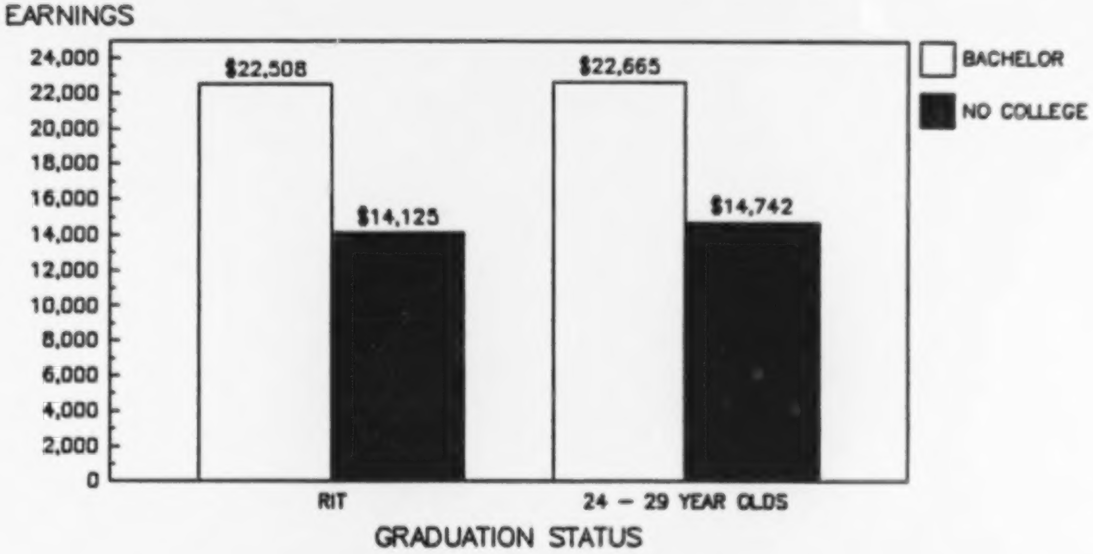
RESULTS

Degree Attainment and Earnings

The fundamental question asked in this paper is; what difference does a degree from RIT make? How much more will a graduate make than a non graduate? Additionally, how does this compare to other persons in the United States of similar age and degree level? Data relative to these questions are displayed in Figure 1.

Figure 1

Earnings of College Graduates and Non-graduates



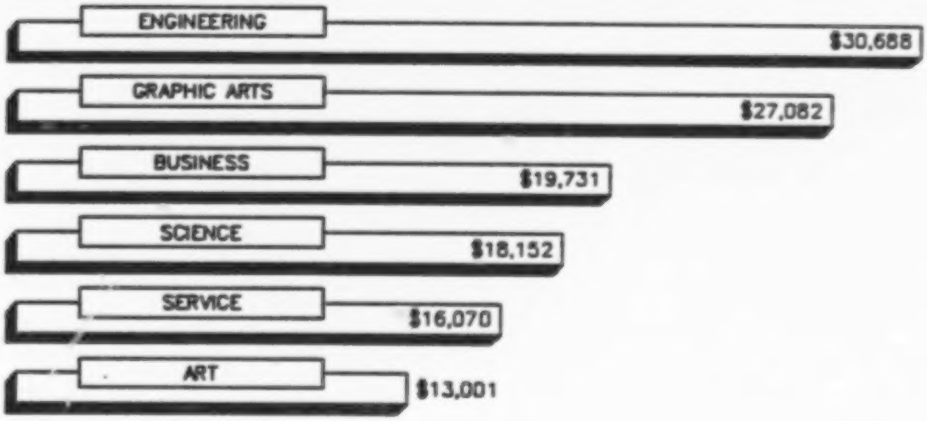
It is clear that graduating from RIT makes a difference in earnings. The differences represented in Figure 1 between graduates and withdraws is significant beyond the .001 level o probability. While this is not surprising, what is interesting is the magnitude of the difference in earnings between those who graduated and those who did not graduate. Those who do not graduate earn only 60 percent of those who graduate. This is especially interesting sine it is probably true that some of the individuals who withdrew from RIT have subsequently graduated from other institutions of higher education. Figure 1 also shows that graduates from RIT also earn salaries that are comparable with other college graduates of similar age in the United States. Considering that a large proportion of persons transferring to RIT do so having completed an associate degree, those who withdraw earn salaries not unlike individuals having completed one to three years of college.

Major and Earnings

It is a well know fact that major area of study and market conditions dictate the amount of remuneration a graduate can demand. These same conditions seem to apply equally to graduates from the Rochester Institute of Technology. Figure 2 shows that graduates in the high tech areas of Engineering, Computer Science and Graphic Arts can command considerably more money in the market place than can individuals in the arts and service occupations. Persons in the Business and Marketing fields earn salaries between these two areas. We hasten to point out that these figures are not to be used as an assessment of a programs effectiveness. Choice of a major for most individuals involves much more than considerations of potential income. A persons interests and aptitudes among other things all enter into this decision. Regardless, the findings demonstrate the level of earnings individuals graduating in the high technologies can demand in the marketplace.

FIGURE 2

Earnings of Graduates by Major Area of Study

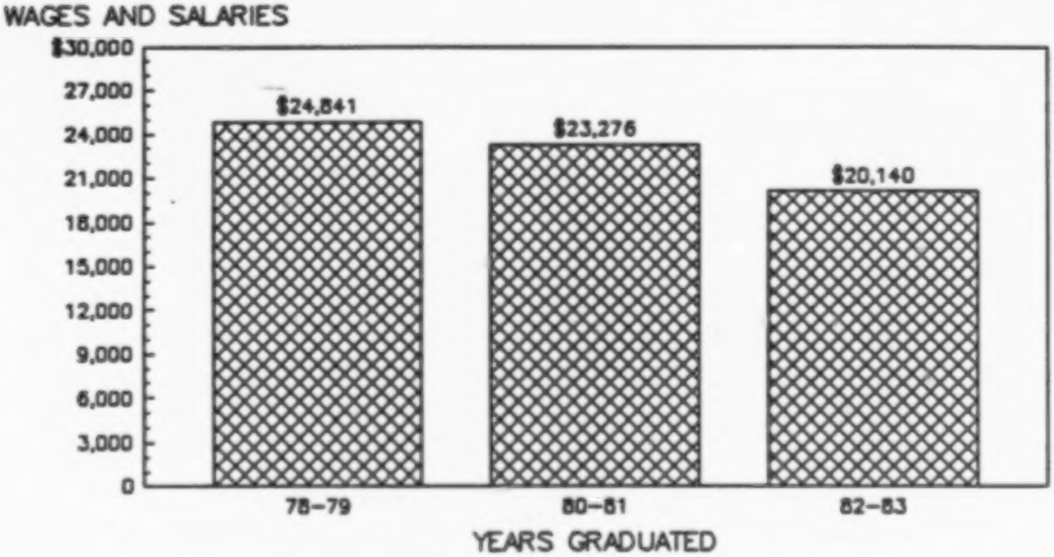


Age and Earnings

The last variable concerns the amount of growth that graduates experience in the period immediately after graduation. Figure 3 show the amount of earnings for the oldest graduates in the sample (six and seven years after graduation) were earning 20 percent more than graduates one and two years out of school. While not a longitudinal analysis, these data indicate that considerable growth in wages occur in the short term after graduation. Such information is potentially useful to alumni development groups in projecting amount of return to alumni giving campaigns after an extended period of time.

Figure 3

1985 Earnings of RIT Graduates by Year of Exit



CONCLUSIONS

While the importance of one's income cannot be denied, it must be recognized that wages and salaries are not the only, or necessarily the ultimate measure of success. Witmer (1978) presents this caution as follows:

> And anyone who invests in higher education merely to realize a monetary return will have missed the central point that the products of higher education–which are as varied as the students and their programs of study–promote the general welfare through the development of whole persons to the limit of their capacities. Monetary rates of return merely indicate market valuations of some of the resultant products in the world of work, which almost never match the valuation of any one person. (p. 57)

Certainly, money cannot guarantee a good life, but it can be used to purchase goods and services that cannot otherwise be obtained. It can buy additional education, assure more leisure time and a grater variety of things to fill that time. If used wisely, money can make the quality of life much better For these reasons the study of income is certainly a critical variable in the assessment of the effects of education.

Results of this study offer impressive support to the notion that a college degree is valuable to both the individual and society. Those with college degrees earn substantially more than those who attended but withdrew without graduating. A degree can mean a difference of $100,00 to more than $300,000 over two decades of work. Those with degrees will also pay many thousands of dollars more in taxes over a lifetime than persons without college degrees while requiring less by way of support such as Social Security Supplementary Income and Welfare payments. In addition, previous studies at RIT (Welsh, Walter and Riley, 1987) have shown that non graduates receive significantly more unemployment compensation than graduates. All in all a person with a college degree will reduce the demands placed on public funding sources.

The arguments put forth in the above paragraph permit college officers to document the economic impact graduates from their programs have on society. These arguments can be useful for institutions seeking increases in public and private.

Internally, the economic benefits of graduating from college can be used by recruiters marketing the institution to potential new students and by persons counseling potential college drop outs. For recruiters it can be used to show students the variations in earnings which are likely to occur through the choice of various majors, and the potential growth in earnings that can occur because of a college degree. Hard facts concerning the potential effects of a decision to drop out of college could act as a powerful tool in influencing the choice to continue. Intelligence of this nature can be a powerful tool when used by a skilled counselor.

Finally, use of governmental tax records clearly can be used for evaluating financial benefits of a college education without compromising confidentiality of individual earnings. In addition, use of such records is superior to questionnaire data because of the unobtrusive nature in which the data are collected. The data used for analyses can be considered to be of the population under study and thus free of the bias that occurs in any sampling methods–this is generally not possible through use of questionnaires. Another advantage lies in the fact that the statistics generated for the analysis can be compared with similar statistics computed on other samples.

In summary, administrative tax records are a potential source of obtaining outcome information for an individual institution, a consortium, or a state wide system. With proper planning, institutional researchers can receive analyses that are very supportive of the return on investment made by individuals and society in providing support for colleges and universities.

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